ABSTRACT

Title of Thesis:	REVIVING THE HEART OF THE CITY: TRANSFORMING BALTIMORE'S OLDEST MARKET INTO THE CITY'S FIRST SUSTAINABLE FOOD DISTRICT
	Eric Bos, Master of Architecture 2019
Thesis Directed By:	Architecture Program Director, Professor Brian Kelly, AIA

This thesis is about food, about how to replenish an abundance of good food, of availability and access in the inner city.

Baltimore's Westside neighborhood in downtown has been plagued by vacancy and dereliction for more than half a century. Public markets have long been cultural and social hubs of cities, yet amidst this backdrop, Lexington Market—Baltimore's oldest public market—sits out of date and in desperate need of a new vision. Through a redesign of the market and the surrounding blocks to better connect this node to the city, a vibrant food-centric community can grow again.

By expanding upon traditional market typologies to include the entire food cycle, the new market effectively responds to the needs of the 21st century. Food is grown, sold, cooked, and eaten on site, sparking cyclical nutrient and energy loops. As urban populations rise and agricultural land wanes, it is more important than ever to secure arable land within cities, vertically. Urban food production reconnects

people with the food they eat, provides local produce with minimal transportation, and can be integrated into the public market. This thesis both revives a struggling piece of public infrastructure and demonstrates the efficacy of bringing super-productive farming into the city.

REVIVING THE HEART OF THE CITY: TRANSFORMING BALTIMORE'S OLDEST MARKET INTO THE CITY'S FIRST SUSTAINABLE FOOD DISTRICT

by

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Advisory Committee:
Professor Brian Kelly, Chair
Professor Emeritus Karl F. G. Du Puy
Professor Matthew Bell

Preface

Several confluent issues provide the impetus for this exploration. At first the goal was to redefine a public market in the interest of the betterment of a great city, but that scope has radically grown. This thesis asks questions about the relationship between urban centers and their fuel, about social and environmental sustainability, and about how an urban intervention can plan for resilience to the effects of climate change. Food is central to this exploration, from the relationships between people and sustenance to the role of food as part of sustainable urban systems.

Dedication

For Rosemary and the next generation of Baltimoreans

Acknowledgements

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Chapter 1: Background

Defining the Problem

In thirty years, the earth's population is expected to rise by two and a half billion. Seventy percent of those nearly ten billion people will live in urban areas, meaning there will be a tremendous increase in urban populations, and thus urban growth[1]. The current paradigm of vehicle-centric sprawling suburbs is unsustainable, future development needs to offer walkable inter-city nodes. As population growth

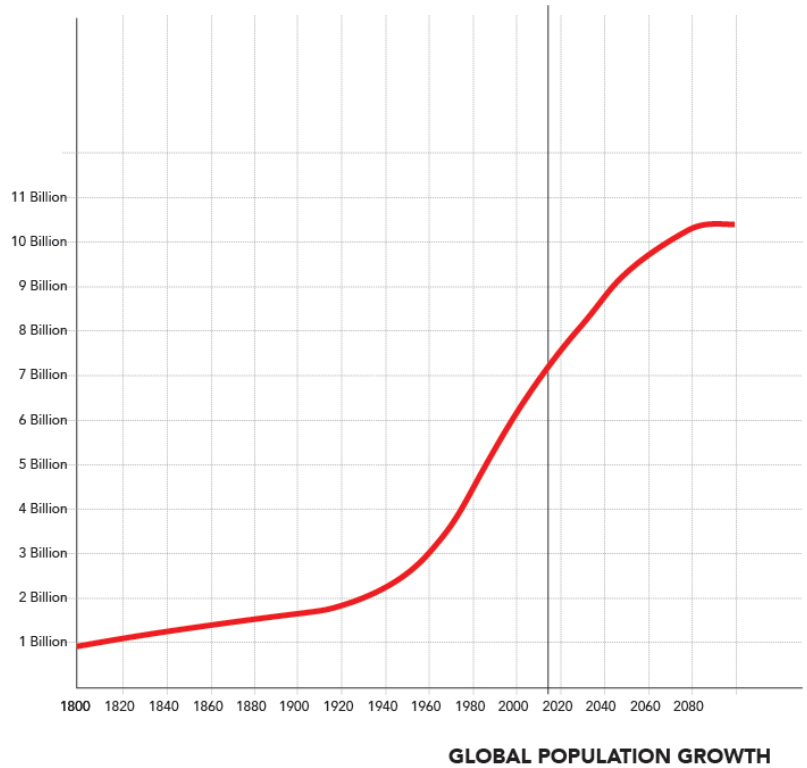

Figure 1: Global Population Growth. Author

[1] Coyle, Bradford D., and Brenna Ellison. "Will Consumers Find Vertically Farmed Produce "Out of Reach"?" *Choices* 32, no. 1 (2017): 1

returns to post-industrial American cities like Baltimore, development can revitalize forgotten corners of the city that once thrived.

Model urban developments are mixed neighborhoods, meaning mixed land uses but also mixed income, age, race, and occupation. New urban nodes should fulfill all of a person's basic needs, providing access to housing, work, transportation, commerce, nature, and food. Food access is a notorious issue in inner city neighborhoods. As of 2018, over 146,000 residents of Baltimore reside in communities with little access to fresh food[2].

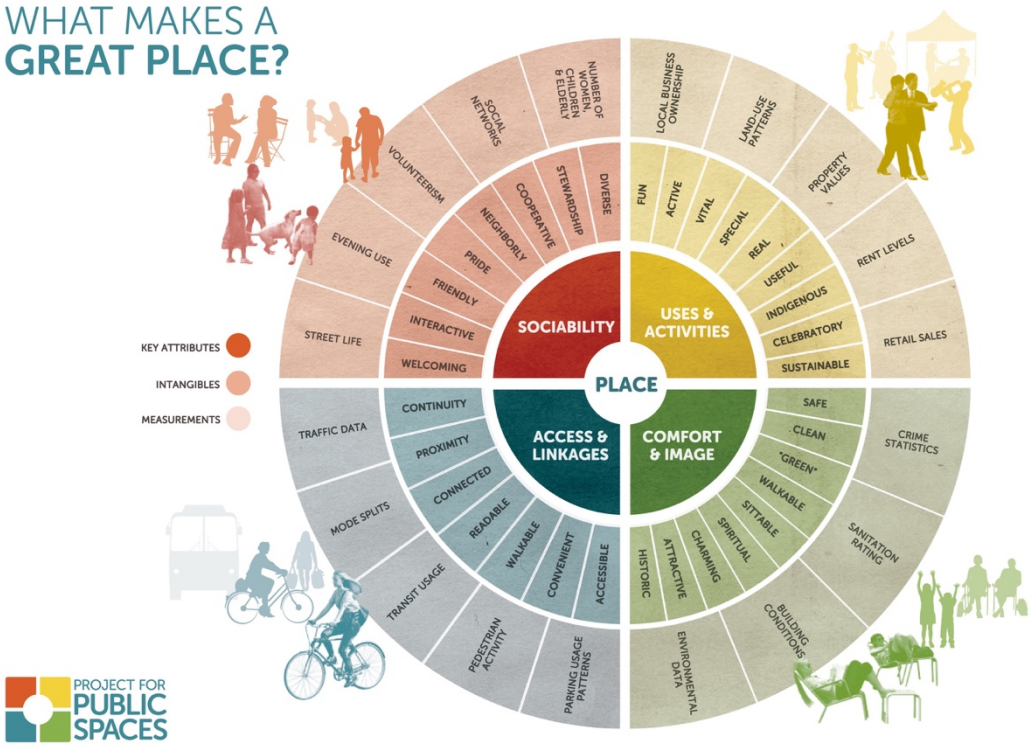

Figure 2: What Makes a great Place? The Project for Public Spaces

[2] Duncan, Ian. *Baltimore rebrands its food deserts: Now they're 'healthy food priority areas'*. The Baltimore Sun. January, 17 2018

This thesis explores the revival of Baltimore's Lexington Market by developing a food centric neighborhood around this historic node. The market was once at the center of the city's retailing core but is now surrounded by vacant and abandoned buildings. This is an opportunity to develop a smarter urban community based not only in food access, but in intensive urban agriculture. As urban populations grow, greater volumes of food must be grown and shipped from farther away, exacerbating climate change, reducing wild lands, and distancing the majority of the population from their food. Urbanity and farmland cannot be opposing forces; food production is necessary within cities to connect people with food and nutrition, to reduce transportation costs and greenhouse gas emissions, and to protect natural ecosystems. This thesis is predicated on the idea that urban food production is a

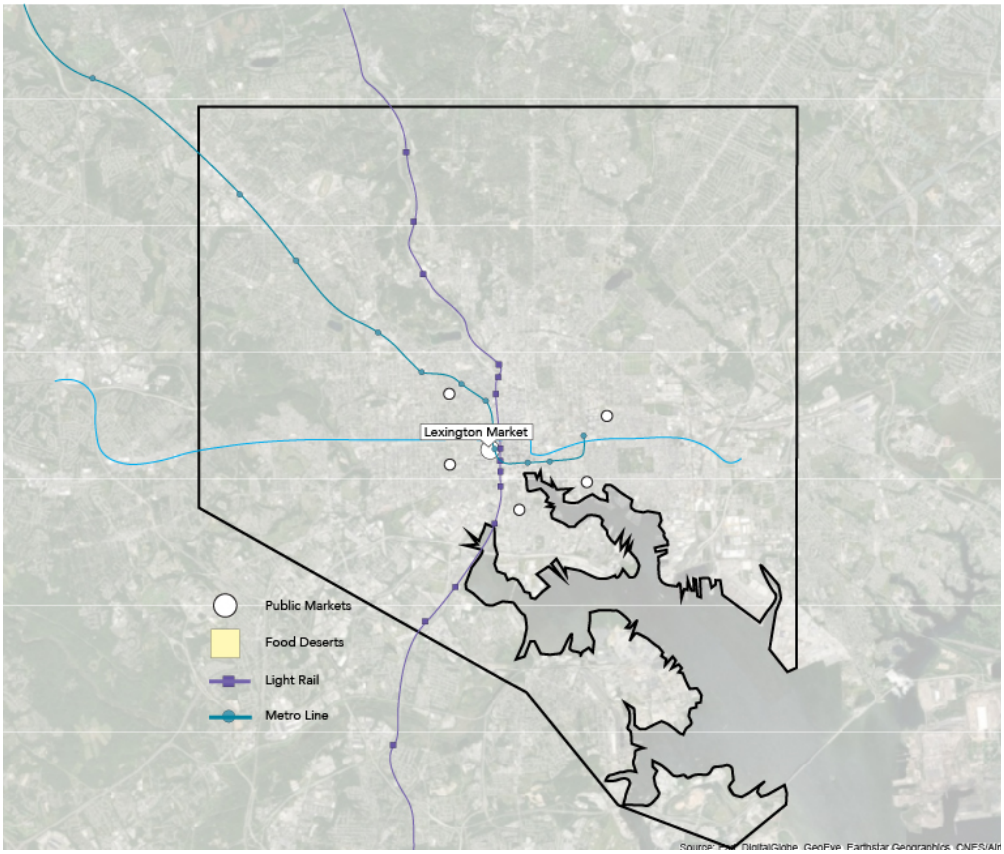

Figure 3: Lexington Market Inner City Location. Arc GIS modified by Author

necessary component of the mixed-use urban neighborhood of future cities. Moreover, expanding the public market typology to include the entire food cycle has the opportunity to close resource loops, using waste and wastewater as vital inputs for food production and resulting in low impact development.

How We Grow Food

Until relatively recently towns and cities were designed on a premise of self-sufficiency. Small urban areas were fed by surrounding farmland, this food distributed at a central market, the market square being the social, commercial, and cultural heart of the city. Diets were seasonal, based on what crops were fresh and what could be preserved. When Lexington Market opened at the end of the Revolutionary War in 1782, it operated much in the same way market squares had for

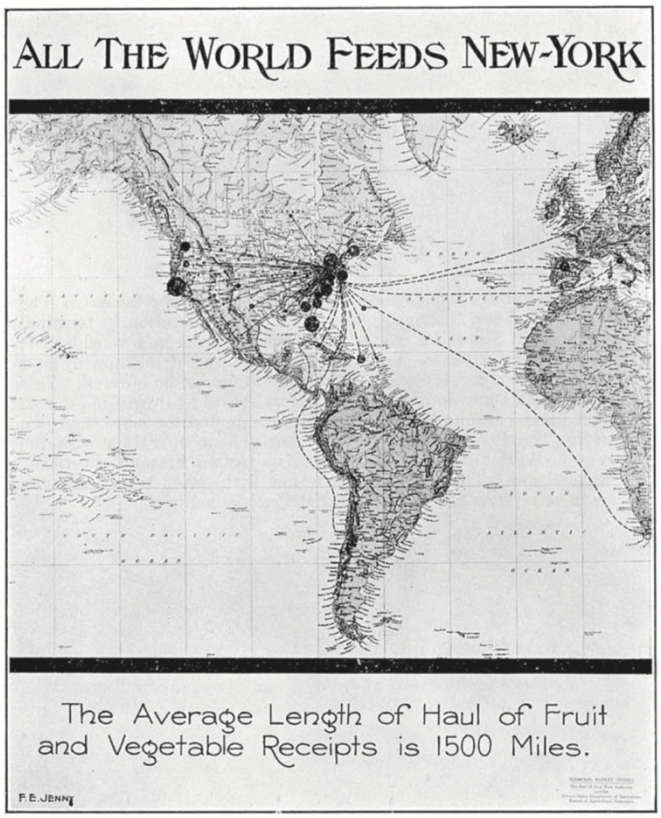

Figure 4: Global Produce Travel. Walter P. Hedden, 1925

millennia. Farmers brought goods from the fields around the city and sympathetic businesses opened nearby: bakeries and butchers for customers; inns, stables, and feed and supply stores for farmers.

A century later with the advent of trains and steamships, cities were no longer dependent on local farms, nor farmers to local demand. Localities which were once responsible for the balanced nutrition of an entire population became specialized in monoculture crops harvested in large quantities and distributed all over the world. That trend has persisted, making the average trip for a piece of produce 1500 miles from farm to table[3]. Monoculture crops, whether wheat, corn, oranges, or almonds, create an anti-ecological landscape devoid of the earth's natural systems. Herbicides, pesticides, and fertilizers are in widespread use killing off plant and animal life both directly and indirectly. Fertilizer use is connected to algae blooms which decimate aquatic life, herbicides and pesticides kill both bees and the flowers on which they feed.

How We Eat Food

Today's food system looks strikingly different from that of the majority of human history. Produce can be season-less through global transportation and production technology. In the early 20th century, this global transportation was seen as a sign of progress, but today is understood as a large contributor of greenhouse gas

[3] Koscica, Milica. "AGROPOLIS: THE ROLE OF URBAN AGRICULTURE IN ADDRESSING FOOD INSECURITY IN DEVELOPING CITIES." *Journal of International Affairs* 67, no. 2 (2014): 177

emissions and results in food that is never really fresh[4]. The self-sufficient cities and towns of the past have transformed into urban areas dependent on imported food to survive[5]. The local food movement addresses this issue by promoting local farms and urban agriculture. When produce is grown locally it can travel from farm to consumer within a day, as fresh as possible, and actually increasing the available nutrients by up to 100% in comparison to the globally transported alternative[6].

There is a schism in the quest for local food systems between the seasonal local and the technological local. Spearheaded by chef Dan Barber of Blue Hill fame, the farm-to-table movement seeks a return to the historic way of food production—intensive crop cultivation throughout the year, eating what grows seasonally[7]. This advocates for a change in diet based not only on the season but on a person's location in the world. Californians could eat just about anything most of the year, Mainers winter diets would be heavily potatoes, beets and preserved food from warmer months. On the other side of the debate is local production using technology, unbinding diets to seasons or place while still producing locally. Donald D. Despommier coined the term "vertical farm" in 1999, but the concept of indoor

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[4] Donofrio, Gregory Alexander. "Feeding the City." *Gastronomica* 7, no. 4 (2007): 34

[5] Koscica, Milica. "AGROPOLIS: THE ROLE OF URBAN AGRICULTURE IN ADDRESSING FOOD INSECURITY IN DEVELOPING CITIES." *Journal of International Affairs* 67, no. 2 (2014): 177

[6] Smith, Jim. "Encouraging the Growth of Urban Agriculture in Trenton and Newark Through Amendments to the Zoning Codes: A Proven Approach to Addressing the Persistence of Food Deserts." *Vermont Journal of Environmental Law* 14, no. 1 (2012): 81

[7] Cowin, Dana. *What the future of food looks like to Dan Barber and Kimbal Musk.* Fast Company. January 11, 2018

agriculture has been around much longer. Greenhouses extend Chef Barber's seasons, but controlled indoor agriculture has the ability to grow food without the sun, and to grow crops in climates in which they would never naturally survive. High-tech indoor agriculture can appease prevailing consumer tastes that demand, for instance, salad greens in January[8]. The way forward needs to be pragmatic, embracing both of these positions. Seasonal food connects people to place, to dirt, to food that can be grown themselves. Indoor agriculture can grow the food that is usually transported the longest, offsetting carbon costs of consumer tastes for non-local, non-seasonal food items.

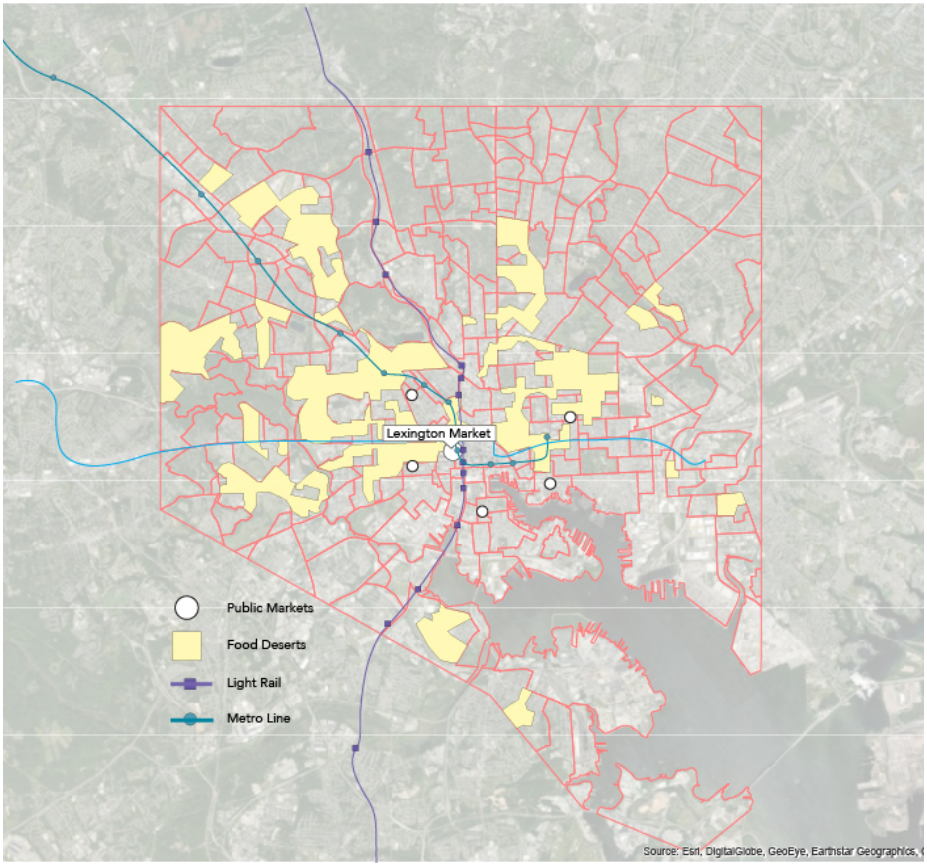

Figure 5: Food Deserts in Baltimore. Arc GIS modified by Author

[8] Cowin, Dana. *What the future of food looks like to Dan Barber and Kimbal Musk.* Fast Company. January 11, 2018

Beyond the global issues described above, urban access to food is of great concern. Baltimore's food deserts ring downtown and encompass nearly a quarter of the city's population. Residents of food deserts have little access to fresh, affordable, or nutritious food, and this lacking is linked to increased instances of diabetes, heart disease, and obesity[9]. In order to increase access in food deserts, food must not only become available but healthy choices must be promoted. Urban agriculture, especially participatory, can bring fresh, healthy food to insecure communities and educate people about food and nutrition. This thesis' urban agriculture and market program is located on both the mass transit lines of the city and is within reach of several food desert communities.

The State of the Market

Lexington Market sits within Downtown Baltimore, in a neighborhood called Westside. It is only four blocks west of Charles Street, the centerline of the city, and only four blocks north of Pratt Street and the Inner Harbor. Despite this central location, the market is surrounded by abandoned buildings, the remnants of a once prosperous retail center. Public markets in Baltimore were once the source of fresh food for large communities whether locally grown or imported, but the suburbanization of the city's population in the post-war decades, and the proliferation of grocery stores responding to new suburban communities, left public markets with

[9] Duncan, Ian. *Baltimore rebrands its food deserts: Now they're 'healthy food priority areas'*. The Baltimore Sun. January, 17 2018

dwindling customer bases and fewer and fewer fresh food merchants[10]. This urban exodus is also responsible for the abandonment of the retail core in Westside.

Today Lexington Market is a maze of shuttered stalls, mini-bodegas, and fried food; the fresh food purveyors that once served 50,000 customers daily are nearly non-existent. The building itself is in need of a new vision, with poor street access, little natural light, and a lack of connection to retail shops on surrounding streets. The condition of Westside is similar, with entire blocks of vacant buildings. What was once the bustling commercial center of the city is now a ghost-town.

In this context, a redeveloped market by itself cannot thrive. The neighborhood needs to transition to a mixed-use node. There are few housing

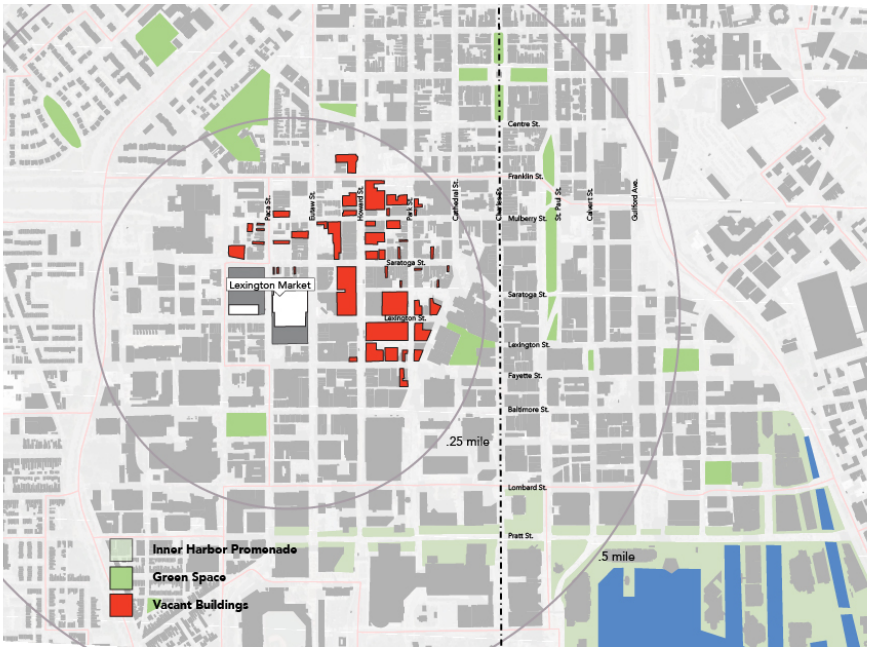

Figure 6: Vacancy around Lexington Market and Proximity to the Inner Harbor. Arc GIS modified by Author

[10] Pietila, Antero. *Not in My Neighborhood : How Bigotry Shaped a Great American City*. Chicago: Ivan R. Dee, 2010. 220-221

opportunities in the immediate area around Lexington Market. Those that do exist struggle because of the lack of amenable resources and inactive, dangerous streets[11].

This thesis envisions a new marketplace within a vibrant, sustainable community. A drastic increase in housing, retail, and community program is paired with large scale urban agriculture in order to close waste and water loops and redefine the market as the center of a sustainable food district. Using food to unite the district engenders an awareness of food and nutrition for local at-risk communities. Large scale urban agriculture brings local food production into the city, with innumerable benefits to both the local community and the greater world. Designing this urban agriculture to co-exist with, and feed off of, housing and commercial uses is evidence of the possibility for zero-waste development in cities of the future.

[11] Klaus Philipson, "That giant sucking sound on Baltimore's Westside." *Baltimore Brew,* Oct. 8th, 2012

Chapter 2: Markets

The Role of Public Markets

Public markets are collections of specialist retailers gathered in convenient locations. But public markets are much more than places to shop, they are often the only reliable place in which customers can interact directly with the people who grow, cook, or otherwise produce the food they consume[12]. While the predominant source of foodstuffs today is retail grocers and supermarkets, 100 years ago public markets were the primary source of fresh food for urban populations. It is widely noted that the rise of grocery stores is coincident with both suburbanization and increased personal vehicle use during the mid-20th century. As a denser, more urban future looms near, with walkable cities prioritized over personal vehicles, public markets are becoming increasingly more relevant. The public market is not just a place to buy or consume food, but is a social space where communities may gather, a cultural hub that appeals to visitors, and an integral piece of the public realm. Many cities, including Baltimore, have embarked on campaigns to revive their remaining public markets, seeing them as integral components to urban regeneration and community growth.

[12] Neil Tomlinson, "Markets—past, present, and future" in *Contemporary Market Architecture, Planning, and Design.* Ed. Neil Tomlinson, Valenti Alvarez Planas (Mulgrave: Images Publishing, 2018) 5-8

Market Typologies

Street Market House

Public Markets are public facilities; the city owns the space and profits off of the stall and shop keepers who chose to do business there. While America's first public markets were open air gatherings, eventually the market house developed to provide sheltered space, a more permanent venue, and reliable income. The oldest American market house typology is the street market house, where a market with central aisle is built in the center of a wide street. This typology developed because, as a public facility, the government needed to buy land on which to erect the structure. Streets were already city-owned public property, so building a street market house was by far the most inexpensive option[13]. Street markets, as linear buildings were also easily expandable. The street market had the greatest flexibility of location and the lowest cost to build. The heightened visibility of street markets, extreme porosity, and stimulation of retail businesses on the street occupied may have been unintended benefits of this typology, nonetheless these factors contribute to the efficacy of the street market as a public node.

Curiously public markets—especially street markets—though public buildings, are often treated in an entirely utilitarian style without the sense of architectural grandeur that accompanies other public facilities like court houses, post offices, or museums[14]. One notable exception to this is Quincy Market in Boston, a

[13] Mayo, James M. "The American Public Market." *Journal of Architectural Education (1984-)* 45, no. 1 (1991): 42

[14] Mayo, James M. "The American Public Market." *Journal of Architectural Education (1984-)* 45, no. 1 (1991): 43

long street market house built of granite, with pediments and porticos and a central rotunda. Quincy market is flanked by two bars buildings, originally warehouses used in conjunction with the market, now all three buildings operate as a holistic retailing destination in downtown Boston. While Quincy Market is treated with a sense of grandeur, spatially it operates much the same as a typical street market. Covered outdoor areas sponsor mobile stalls and small businesses, market stalls line a central aisle in the main building, and associated retail frontage encloses both sides of the street. Effectively the market has three streets with retail frontage, two outdoor and one interior.

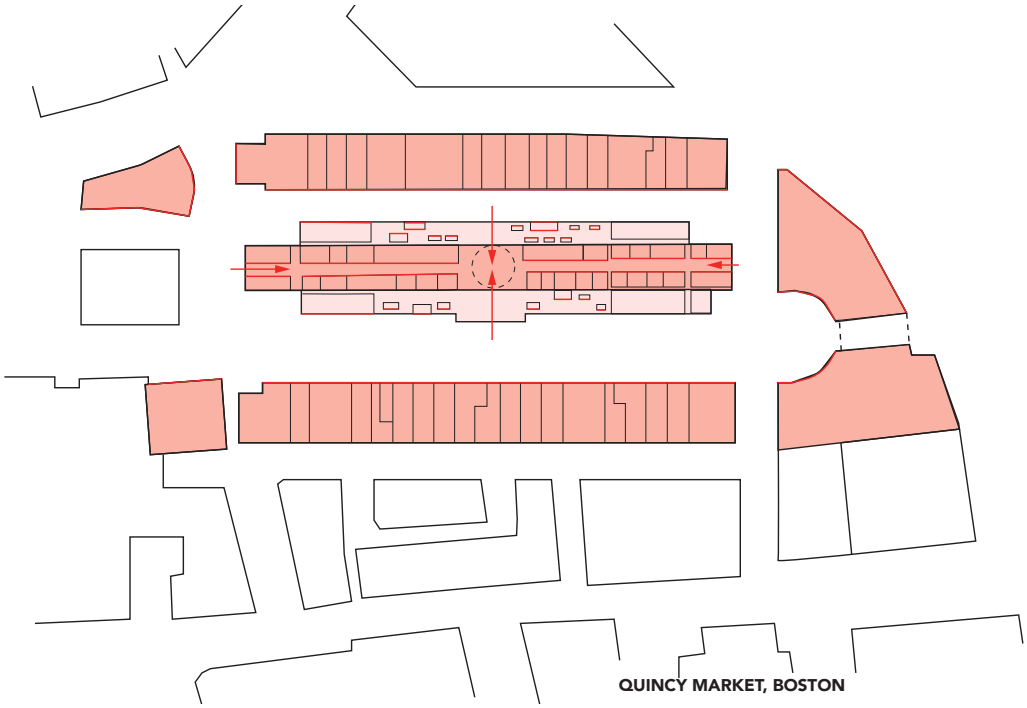

Figure 7: Quincy Market, Boston. Author

Generally, the street market structure was seen as a temporary obstruction, a sentiment that would lead to the demise of street markets throughout the country in

the mid 20th century[15]. As congestion in cities increased, street market houses and the street vendors clogging nearby streets were seen as impediments to civic growth and transportation efficiency. Many street markets were removed or replaced, including Baltimore's Lexington Market, and a new market typology gained popularity—the market as a block.

Market Block

Block markets sought more efficient floorspace by condensing linear street markets into matrices of stalls in a large interior space. Customers would have less distance to travel to reach goods and floor space could be flexible and adaptable, rearranging stalls as needed. The market block experience differs wildly from the street market in that customers must physically enter a building to get to the market—like entering a grocery store—whereas the street market typology put the market in public space. The current Lexington Market is a block market where customers must enter through double doors to experience the market. In Lexington Market each stall is an island, and has four sides if frontage, leading to confusion as there is no hierarchy of circulation or clear system to determine which of these four sides a particular vendor will use as the "front." A better example of the block market is the Mercato Centrale in Florence, where stalls are arranged in blocks of six or eight creating a more navigable space with clear retail frontage and potential for shared

[15] Mayo, James M. "The American Public Market." *Journal of Architectural Education (1984-)* 45, no. 1 (1991): 44

back-of-house space. Four main entrances bring people in from each side and a visible central stair informs visitors of the existence of an upper floor.

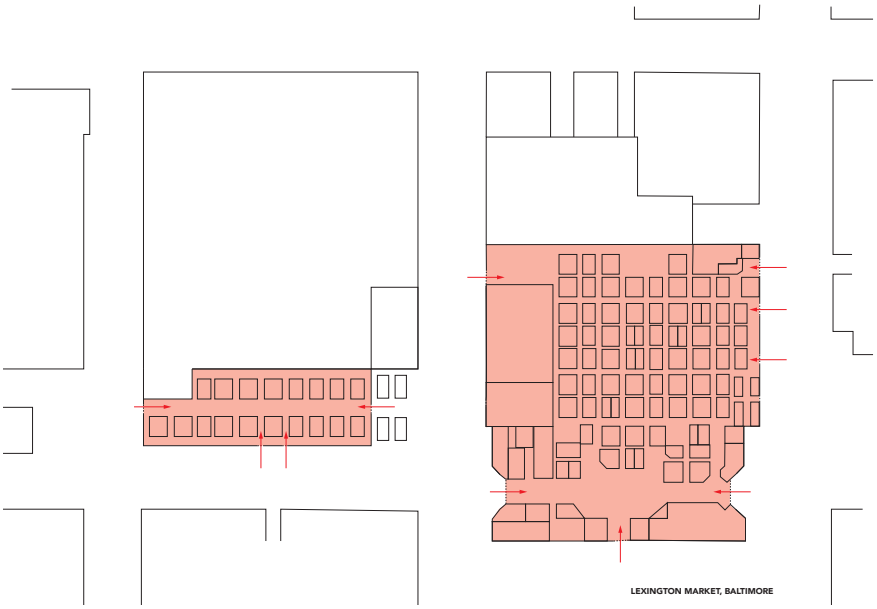

Figure 8: Lexington Market, Baltimore. Author

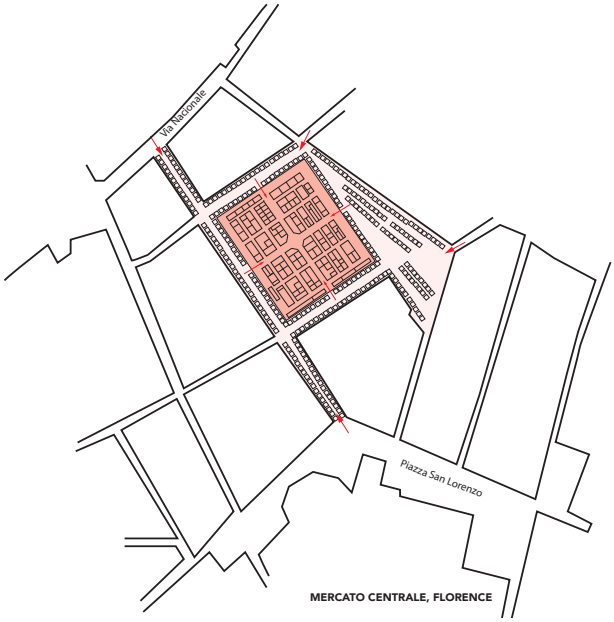

Figure 9: Mercato Centrale, Florence. Author

Another type of block market uses the interior of the block for covered, open-air market space. The user experience of an open-air block market is more similar to

the street market, where the market feels more public. Spitalfields Market in London is a unique example of the block market, where an interior block is sheltered and filled with market stalls, and the exterior frontage is associated retail and restaurants. Gaps between small buildings are effortless entrances to the interior market. Here the market operates as not just a commercial hub but promotes pedestrian paths through the block emphasizing the market as a public amenity. The block market developed in America as a way to remove people and goods from public spaces, to increase consumer efficiency. Today people value the experience of social, cultural spaces; space for wandering and exploration are important. Spitalfields Market uses the interior block to its advantage, effortlessly connecting with public space to create an exciting and intimate experience where customers may have chance encounters with any number of vendors without entering a market building.

Figure 10. Spitalfields Market, London. Author

Market Neighborhood

Public markets are often paired with more traditional retail stores, creating commercial streets or blocks. That relationship can expand into the market neighborhood, where a series of blocks all have associated retail frontages and market stalls, and streets are used for temporary market vendors. The quadrilatero district of Bologna is a market neighborhood, where the maze of tight medieval alleys all host varieties of foodstuffs and small cafes, now anchored by a multistory interior marketplace, Mercato Mezze. While that may be more typical of older European cities, the market neighborhood Pikes Place Market thrives in Seattle.

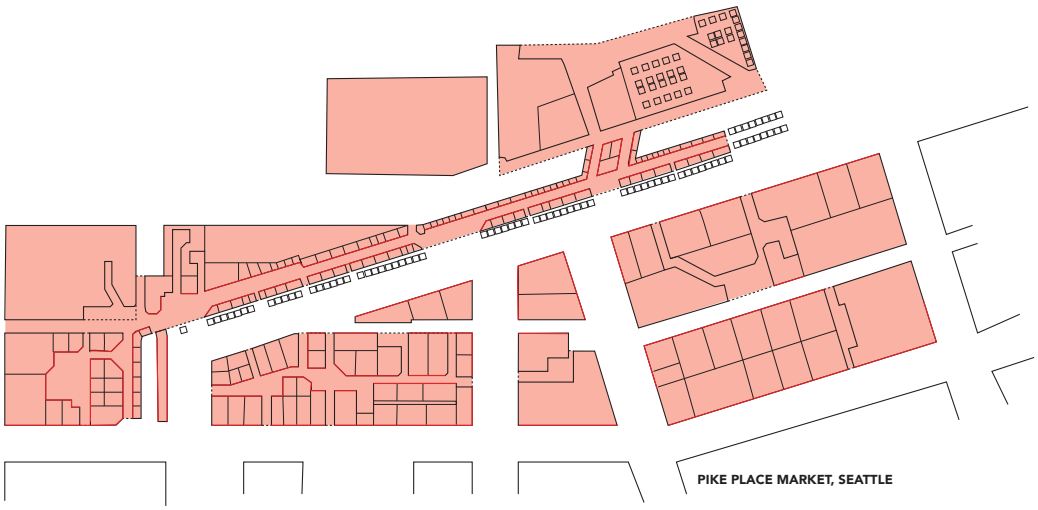

Figure 11. Pike Place Market, Seattle. Author

Pikes Place is a large public market comprised of both long linear arcade markets and interior block markets with dozens of restaurants and retailers taking up adjacent street frontages. The streets and alleys are used for temporary marketplaces, and pedestrian oriented circulation makes for a delightful meander down streets, alleys and interior streets all with food vendors, hole-in-the-wall eateries, and

craftspeople abounding. Pikes Place is much more than a consumer marketplace, it is a holistic neighborhood, with numerous housing options, many publicly subsidized, and childcare and healthcare facilities. The market is successful because of its variety, not only in goods, but in types of vendor opportunities. There are small permanent stalls, larger stalls, small stores, larger stores, space for street vendors, consignment shops for crafts and antiques, and restaurants, bars, and eateries of all scales. There is opportunity for anyone who wishes to sell, and for a wide range of users who live on site, who work in nearby downtown, or who are just visiting.

Baltimore's Markets

Baltimore at its height had eleven public markets, one wholesale dealing with crates of produce shipped form far away, nine neighborhood markets, and one central public retail market—Lexington Market[16]. Of those only six remain. The markets today reflect a different purpose than their origin, most no longer sell fresh produce, meat, and fish, but instead are gatherings of small restaurants. Fresh produce and meat can be found at several weekly public farmers markets, but rarely at a permanent market location. Cross Street Market in Federal Hill and Broadway Market in Fells Point have both undergone recent renovations to renew interest, and both of these markets still exist in an ideal urban fabric, street markets with an eclectic retail and restaurant mix lining each side of the street. Broadway Market exists in a linear

[16] Thrift, James F., and William T. Childs. "Baltimore's Markets." *The Annals of the American Academy of Political and Social Science*50 (1913): 120

public space that transforms from market-hall to an outdoor shared patio, to another market-hall, to a large plaza, and finally to a public pier jutting into the harbor. The

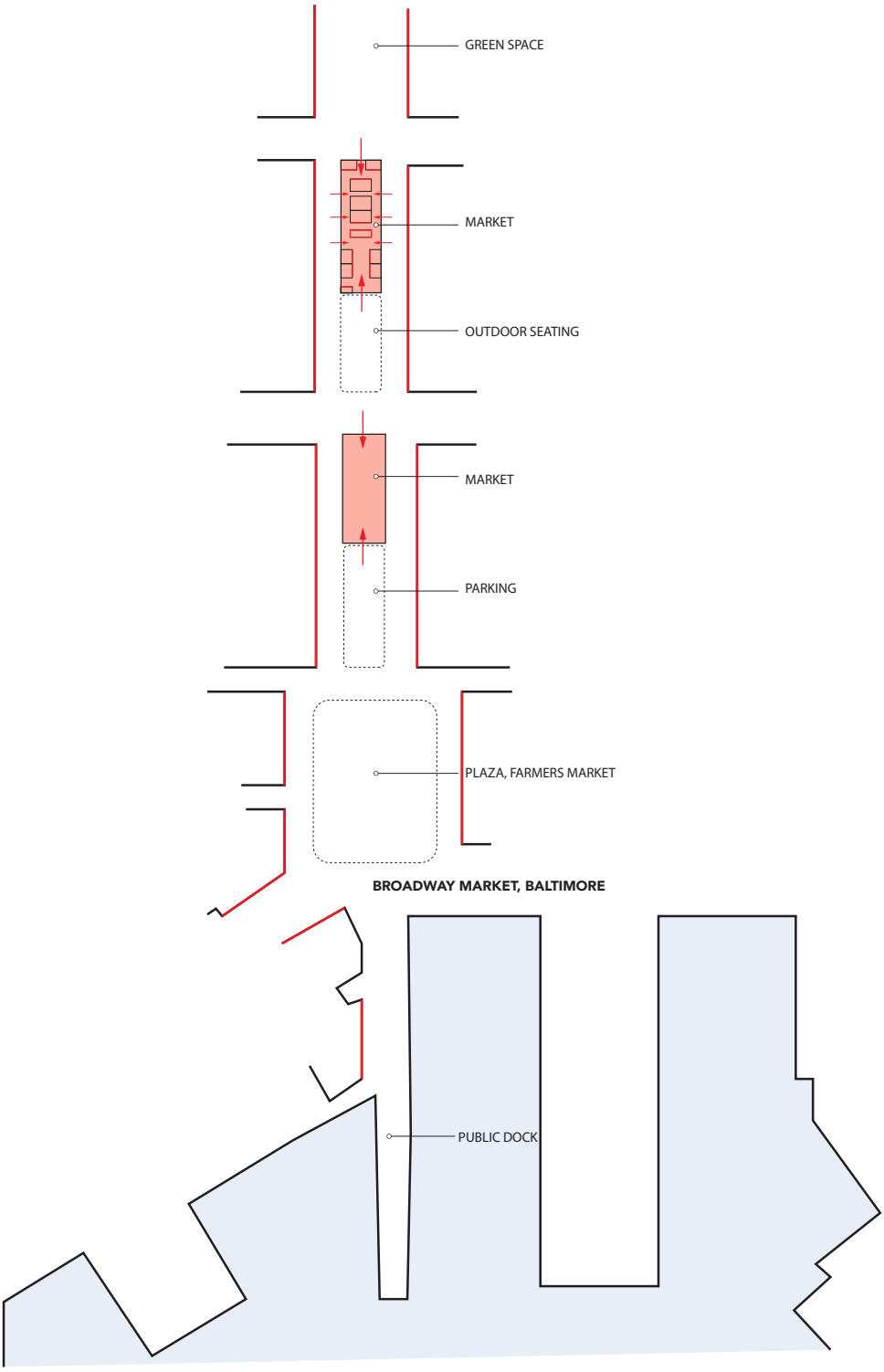

Figure 12. Broadway Market, Baltimore. Author

market is a part of a larger public promenade that draws people through the neighborhood.

The recently re-opened market has a barbell plan rather than a traditional central aisle, giving the exterior walls to seating areas with ample light, and numerous secondary entrances. Stalls are all micro restaurants and vary in size, most have counters and barstools. The original market included some stalls with bars facing the street, where people could walk up, order, and eat outside under a covered awning. The outdoor seating space between the two market buildings references not only the two market-halls but the surrounding bars and restaurants as well, providing outdoor social space for a larger community. The large plaza between the market and the dock is used for a farmer's market during the warmer months.

Beyond the public markets, several market-like food halls have opened in Baltimore in the past few years. Mount Vernon Marketplace hosts a series of small restaurants, oyster bar, and crafts in the ground floor of a warehouse-turned-apartment building. Stalls are laid out in a circuit with numerous small seating and eating areas spread throughout. A continuous glass exterior invites people in, and sidewalk seating lets customers spill out into the public realm. There are generally two size stalls, smaller ones about 150 sqft, larger around 500 sqft. The larger stalls all include full bars and liquor licenses. The space transforms from variety luncheon during the day, to bar-crawl at night.

Just to the Northwest of Mount Vernon, R House takes a slightly different approach. The food hall includes nearly a dozen eateries all in a line with one large seating area spilling out to a patio through operable glass garage doors. A centrally

located bar serves drinks, with table service on weekends. The layout is much like a shopping mall food court, which is easy to navigate, but lacks the nuanced experiential quality of finding something to eat at a more traditional market. Neither R house nor Mount Vernon Marketplace exist in the public realm the way street markets like Broadway and Cross Street do. Street market-halls are unique in the city because they are something additional to the streetscape. They have high visibility and sponsor public spaces beyond the sidewalks of retail streets.

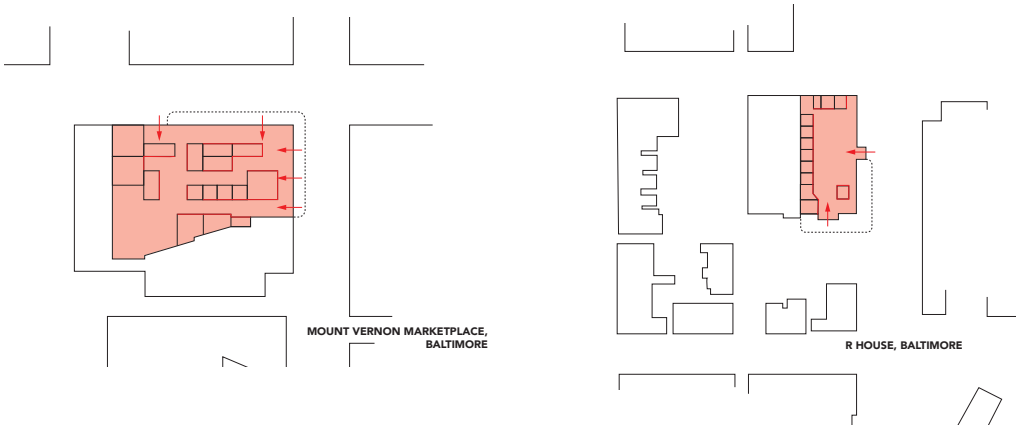

Figure 13, 14: Mount Vernon Marketplace and R House, Baltimore. Author

The central farmer's market in Baltimore is by far the largest market in the city, with over one hundred vendors selling produce, food goods, and crafts, and several small eateries. The market appears under the highway downtown every Sunday, providing reasonable shelter from rain for vendors and patrons. The market is set up in a long circuit, a continuous promenade that lets patrons examine goods at each table and recirculate to buy the best options in one continuous motion.

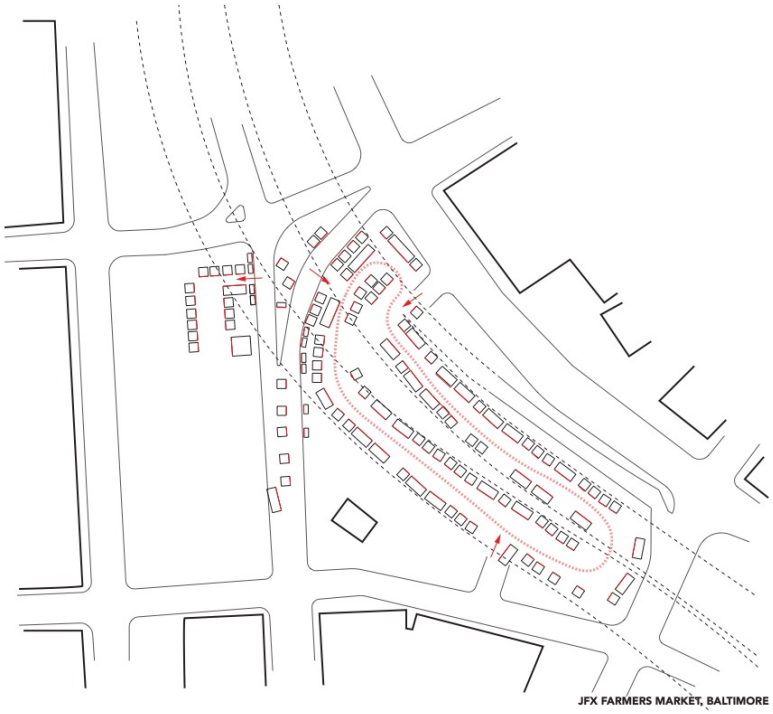

Figure 15: JFX Farmer's Market, Baltimore. Author

Food Hubs

As mentioned earlier, farmers and producers have little space in public markets today, instead being represented in temporary and seasonal farmers markets. In Baltimore, the major farmers market occupies a series of municipal parking lots every Sunday under the highway downtown. This gathering includes over one hundred stalls selling a wide variety of foodstuffs and local food products.

There are some examples of expansion of public markets to include space for temporary farmers markets, like Pikes Place and Broadway Market, but the inclusion of food production is more speculative. Projects like the Baltimore Food Hub, still in planning phases, aim to combine food production, job training, restaurants, and green space as a food-oriented community building project. Larger speculative projects like

the OMA-designed West Louisville Food Port combined indoor intensive farming, outdoor demonstration farms, food product production, packaging, and distribution with space for farmers markets and food truck rallies. This project is aimed to link community-oriented programming with industrial scale local food output. The inclusion of urban agriculture with markets and food retailing provides a crucial link in the project making a closed food cycle possible. Food is grown, packaged, distributed, sold, and eaten on site and clippings and organic waste can be collected and composted. This compost can be used as vital nutrient input and growing medium for urban agriculture.

Chapter 3: Urban Agriculture

Summary of Global Issues

Food production, like water filtration, transportation, sanitation, and shelter is a necessary component for human survival. It is hard to imagine a city without potable water, a transportation system, sewers, trash collection, and houses, but food production relegated to something other, something distinctly un-urban. Cities are dense, by nature, and farming takes space. Globally on average, there is 0.5 acres of farmland per person, with the addition of rangeland for cattle and other animals that metric reaches 1.5 acres per person[17]. With a global population increase of 2.5 billion by the year 2050, if this trend continues an additional landmass the size of South America will be needed to feed the worlds people as we do today. This land does not exist. In order to expand farms to feed the increasing global population, natural habitats would be razed for monoculture crops, ecosystems would be severed, and climate change would be exacerbated. Fortunately, this is not the only way to grow food. Intensive soil farming, where many species are grown in close proximity to each-other yields three times the product per acre of monoculture farming. By bringing that farm indoors into a controlled environment the yield increases by 14 times[18]. By stacking that indoor farm into a tower, the yield per acre increases again.

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[17] Food and Agriculture Organization of the United Nations. *Crop Production and Natural Resource Use.*

[18] Koscica, Milica. "AGROPOLIS: THE ROLE OF URBAN AGRICULTURE IN ADDRESSING FOOD INSECURITY IN DEVELOPING CITIES." *Journal of International Affairs* 67, no. 2 (2014): 181

Vertical farms are theorized to be able to feed a person with 25 ft^2, an efficiency nearly 1,000 times greater than the current paradigm[19].

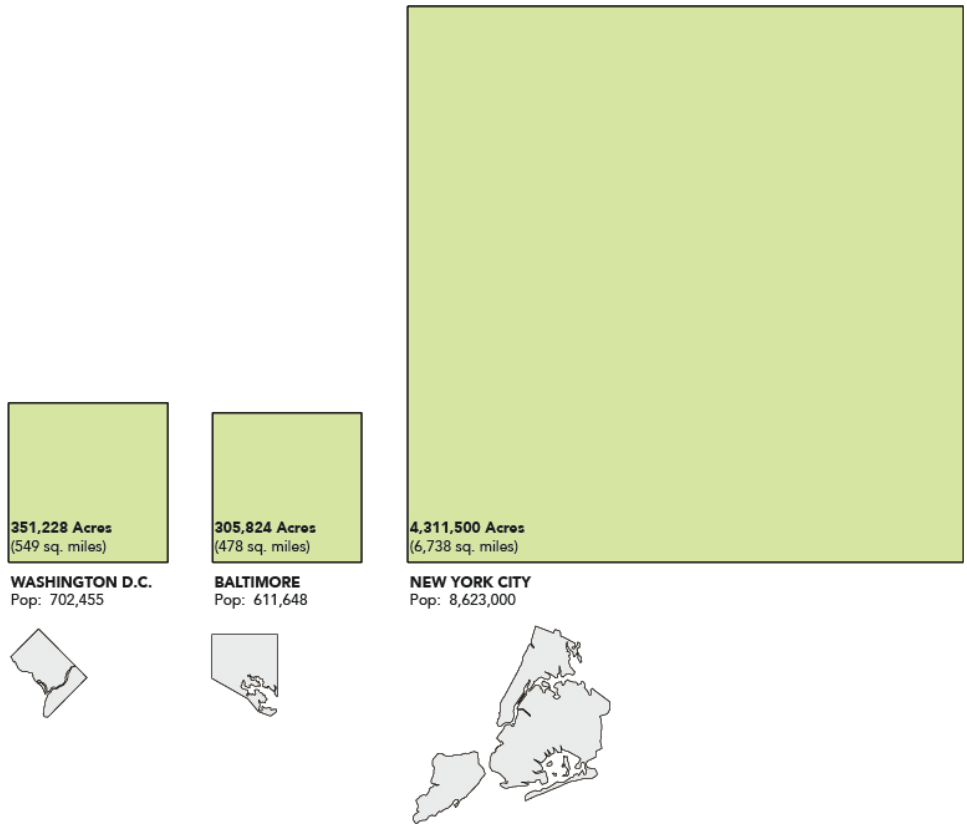

Figure 16: Necessary crop cultivation area vs land area of select cities. Author

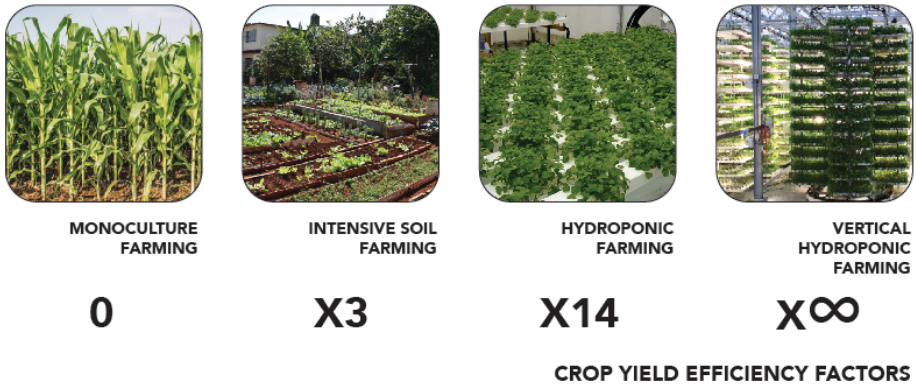

Figure 17: Crop Yield Efficiency Factors. Author

[19] Frazier, Ian. *"The Vertical Farm: growing crops in the city without soil or natural light."* The New Yorker. Janurary 1, 2017

The Case for Urban Agriculture

The capacity for good of vertical farming is layered. Vertical farms, being in controlled indoor environments, have no need for pesticides and herbicides, leaving the natural environment to thrive. By being distanced from the ebbs and flows of outdoor conditions, droughts and floods do not affect yields. The yield of an acre of indoor farmland is fourteen times greater than an acre of outdoor land, and that yield is continuous throughout the year. Indoor agriculture is continuously productive, where traditionally there is a short timeframe for harvest of any particular crop. Vertical farms can also transform wastewater into drinking water. Wastewater is full of nutrients that plants need and can be used, lightly treated, for growing produce. The water that is evapo-transpired from plant leaves can be collected as pure, drinkable water. Indoor agriculture does not result in top-soil erosion, nor nutrient runoff, nor algae blooms. The compact footprint of vertical farms also allows for collection of plant matter for energy generation through biogas digestion[20].

Urban agriculture in general has many more benefits, not specific to indoor vertical farms. Food grown locally greatly reduces transportation costs, both in terms of actual money, reducing the price of the food, and in carbon emissions and climate change. Urban agriculture connects people to food, urban communities, especially food deserts, have been shown to be healthier communities when connected and

[20] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 29

aware of the food they eat[21]. Growing food in at risk areas provides effortless access to food as well. Increasing the productivity of available space within cities equates to land outside of cities that can be left wild, or farmland returned to a wild state. This concept of "benign neglect" of former farmlands can help mitigate climate change through restoration of natural ecological systems[22].

Urban Agriculture Archetypes

The ideal form of urban agriculture does not have a specific type or place, does not use a specific technology. Ideally urban agriculture is varied, like the cities that host it. A holistic approach to food production includes three archetypal forms: the urban forest, sustenance garden, and super productive landscape[23]. The urban forest refers to greening the city with edible plants, lining streets with fruiting trees, and letting food exist in the wild in the city. This concept is present in Andre Viljoen's urban design strategy of "continuous productive urban landscapes" (CPUL). This strategy mixes public and private open space in cities, claiming food production and park-space can act together to form green seam in cities. Theoretically, CPUL's can take existing public parks and connect them through small urban gardens, green-roofed parking garages, and edible lined streets, creating a large system of both

[21] Smith, Jim. "Encouraging the Growth of Urban Agriculture in Trenton and Newark Through Amendments to the Zoning Codes: A Proven Approach to Addressing the Persistence of Food Deserts." *Vermont Journal of Environmental Law* 14, no. 1 (2012): 80

[22] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 32

[23] Biel, Robert. "Built Systems, Biomimicry and Urban Food-growing." In *Sustainable Food Systems: The Role of the City*. London: UCL Press, 2016. 93

recreational green space and decentralized urban agriculture[24]. Perhaps the most striking example of the urban forest is Todmorden, England. In Todmorden in 2013, a volunteer group called "Incredible Edible" started a guerilla garden project using any open space or lot in the city to grow edible plants. The gardens provide free produce to anyone willing to pick it and repurposes vacant and underused spaces in the city. This initiative goes far beyond the community garden, transforming the baseline city landscape into an edible place where access to fresh and free food is unavoidable.

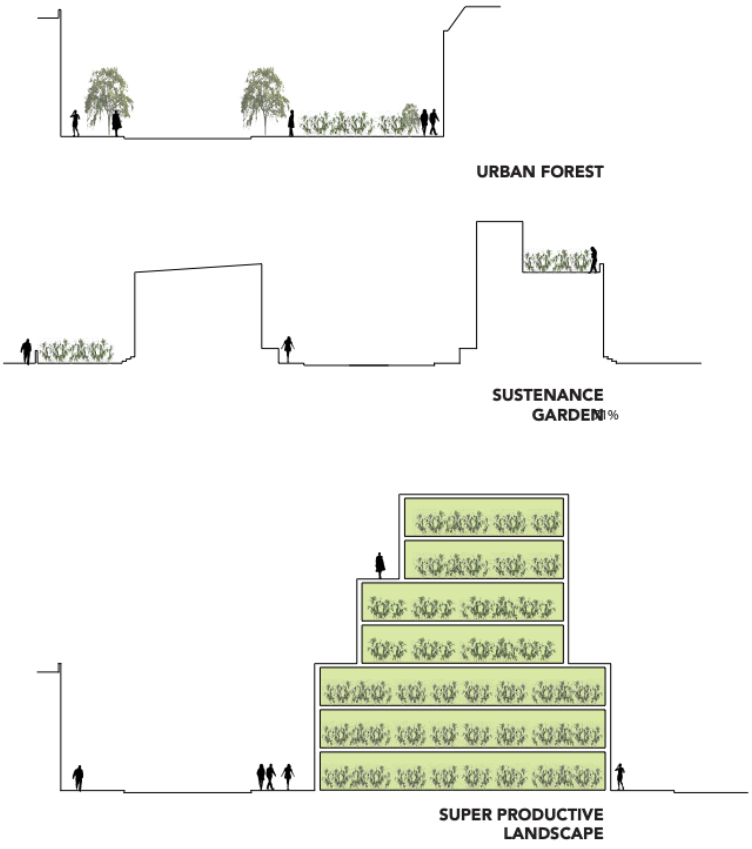

Figure 18: Urban agriculture archetypes. Author

[24] Viljoen André, Katrin Bohn, and J Howe. *Continuous Productive Urban Landscapes : Designing Urban Agriculture for Sustainable Cities*. Oxford: Architectural Press, 2005

The sustenance garden is the most common form of urban agriculture. This is a personal plot or community garden growing food for a small number of people. Generally these gardens are for community building, education, and personal use, but some cities like Seattle have passed legislation allowing food grown in sustenance gardens to be sold at farm stands or markets[25].

The super productive landscape refers to high-tech indoor agriculture. Vertical farms have the capacity to feed large amounts of people on small footprints. The compact and connected nature of vertical farms makes integration with urban infrastructure possible. Produce can be distributed directly into urban areas, and waste from nearby homes and businesses can be used as nutrient input for crops. Plant clippings and food waste from nearby restaurants and homes can be collected for biogas generation. The outputs of biogas digestion are combustible biogas, mostly methane, which can be used to fuel the vertical farm, heat which can be used to control the temperature of the farm, and nutrient rich compost which can be used as a soil amendment in urban agriculture of all kinds.

In order to avoid an unnecessary carbon footprint, it is necessary that indoor agriculture operate with the same ecological processes as traditional plant life: free energy and water input, clean water and food out[26]. Because a vertical farm operates in an indoor controlled environment, energy is used to heat or cool the air and for

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[25] Smith, Jim. "Encouraging the Growth of Urban Agriculture in Trenton and Newark Through Amendments to the Zoning Codes: A Proven Approach to Addressing the Persistence of Food Deserts." *Vermont Journal of Environmental Law* 14, no. 1 (2012): 85

[26] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 30

artificial lighting. In order to operate ecologically equivalent to traditional agriculture, this energy must be created on site in a net-zero energy environment. Biogas digestion is one method of energy generation particularly suited to large scale agricultural operations. Solar energy collection on roofs and facades, and wind turbines are also feasible energy generation strategies. Outdoor agriculture uses a large amount of potable water in order to grow crops, however natural plant growth on earth uses only available rainwater to grow, nothing added. Vertical farms use low-water growing technologies to minimize water usage. To create further benefits, the water used in indoor urban farms can be recycled wastewater that, through the growing process, can be converted to potable water[27]. By designing vertical farms to be net-zero energy and to use and treat wastewater they can have a positive environmental impact.

Methods

Indoor agriculture has many forms with varying levels of technology and control over the growing environment. The greenhouse is a low-tech indoor option still reliant on the sun and soil, hydroponics and aeroponics represent high-tech systems that can operate without sun or soil. In addition to plant life, fish and shellfish can be farmed indoors and operate in a symbiotic system with produce called aquaponics.

[27] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 29

Greenhouses are an important urban agriculture tool, the greenhouse captures heat and light in the beginning and end of the growing season, effectively lengthening the natural growing season by two months. Using greenhouses can increase yields on small urban plots and function best with ample sunlight. Because greenhouses are glass-roofed, they are still dependent on the seasons for crop production. In the summer, hot air must be constantly ventilated. In the winter, the sun is not intense enough to create a warm growing environment. The real advantage comes at the beginning and end of the growing season, when greenhouses can capture enough light and heat to extend the season[28].

Greenhouse agriculture relies on soil to grow crops and can be a convenient repository for compost generated by larger indoor operations. Greenhouses can be small, fitting comfortably in back yards or on roofs, but the concept can be scaled to larger sizes, creating artificially warm environments for large or non-native plants. One example of a large-scale greenhouse is Baltimore's Rawlings Conservatory, which is large enough to grow fifty-foot palm trees. In the context of large-scale indoor farming operations, greenhouses can be used to grow crops which need a lot of space—squash, melons, or tropical fruit. Smaller stackable plants are more ideal for high tech systems.

Hydroponics refers to plants grown in nutrient-rich water where roots are supported by an inert material (growing medium). The medium is commonly coconut husks, rockwool, or vermiculite. Because of easy access to essential nutrients, crops grow 25% faster and produce 30% greater yields than plants in soil. Roots grow

[28] David Ross, phone conversation with the author, April 24, 2019

smaller than usual because they don't need to actively seek water[29]. Hydroponic systems can be used in controlled indoor environments where light is provided by LED's and greater crop density is achievable. The nutrients needed to grow plants traditionally comes from the soil, from minerals and decomposing material. Hydroponic systems usually specify chemical nutrient cocktails designed optimally for specific plants. There are six main types of hydroponic system, each optimized for a particular type of plant or growing method.

Deepwater culture systems, also referred to as Reservoir Systems, submerge plant roots in the nutrient solution. A bubbler oxygenates the water, and roots absorb oxygen along with nutrients directly from the solution. There are no nozzles or hoses involved, the only energy use is through the aeration pump. This system is good for larger plants with big root mases and heavy fruiting plants like tomatoes or bananas[30].

Nutrient Film Technique (NFT) uses a constantly moving film of nutrient solution. Plants are suspended over a trough with just the tips of roots touching the solution. The troughs are slightly angled, allowing gravity to move the solution. The solution is collected in a reservoir and reused cyclically. The plants absorb oxygen directly from the air where it is most available. This is the most scalable hydroponic system as the length of trough is indeterminant and other than the growing area only requires a reservoir to catch excess liquid and a pump to recycle it. This system is best for small-rooted plants like leafy greens and herbs. Larger fruiting plants can

[29] Full Bloom Hydroponics. "Hydroponic Systems 101"

[30] Jones, Benton J. *Efficiency is the future of hydroponics.* Hydroponics Articles, Garden and Greenhouse. May 2014

grow in this system but large root masses can cause blockages and anaerobic patches that hurt the roots[31].

The Ebb and Flow system floods a growing medium with water, soaking the roots, then drains completely and repeats on a plant-specific schedule, similar to watering a potted plant. The period of drought encourages root growth as they seek water, when the plants are next flooded they uptake more nutrients because of the larger roots[32]. Like the NFT, this system drains into a reservoir and the solution is recycled. This system is best for plants that do well with periods of drought, like peppers.

The Drip system uses small hoses and nozzles positioned at each plant to slowly drip solution into the growing medium. This keeps the plants consistently hydrated. Drips can be frequent in a non-absorptive medium, or infrequent in a medium suited for holding water. This system can be scaled for any size or type of plant, however the amount of equipment (hoses and nozzles) needed and their tendency to clog due to the high mineral content and drip speed make this system more expensive and labor intensive.

The Wicking system uses no outside energy for pumps or aeration. Nutrient solution is passively brought to the growing medium by wicking action of a cotton or nylon fabric suspended in the reservoir. Because only small amounts of water are brought to the growing medium, this system is best suited for smaller plants and those requiring less water.

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[31] Shroyer, Sam. *Hydroponics is as easy as NFT!.* Hydroponics Articles, Garden and Greenhouse. November 28, 2012

[32] Full Bloom Hydroponics. "Hydroponic Systems 101"

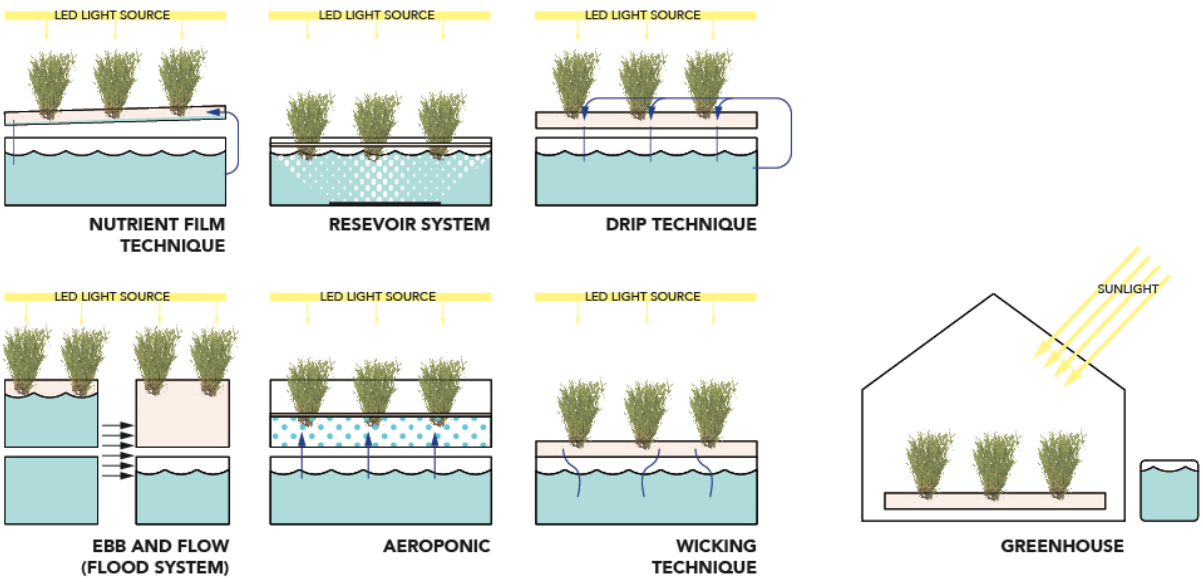


Figure 19: Indoor agriculture methods. Author

Aeroponics is a subset of hydroponics which uses 70% less water than the systems described above[33]. Instead of nutrient rich water, roots are suspended in a fine nutrient mist. This is by far the least water intensive form of agriculture. Aeroponics has been perfected by Aero Farms of New Jersey. They use a patented growing medium, a fine wool made from shredded recycled plastic bottles, to sprout and grow microgreens and other high-return produce. This growing medium, when plants are harvested, can be scraped clean for compost, and then washed in a washing machine and reused. Aero Farms' operation is entirely divorced from nature, LED lights are engineered to provide the exact amount of light needed in specialty light cocktails, and the air in the farm is pumped with extra CO2 to help plants grow faster. Their products are available in local northern New Jersey stores. While their direct

[33] Koscica, Milica. "AGROPOLIS: THE ROLE OF URBAN AGRICULTURE IN ADDRESSING FOOD INSECURITY IN DEVELOPING CITIES." *Journal of International Affairs* 67, no. 2 (2014): 177

competitors travel for days from farms in California and Mexico, Aero Farms greens take 11 minutes to get from harvest to shelf[34].

Closing Nutrient Loops

Often these systems are used in combination with each other to create more effective growing systems. All require a monitored water system to ensure ideal pH, nutrient levels and temperature. The ideal pH for the solution is 5.8-6.2, slightly acidic where plants best absorb nutrients[35]. The fertilizing nutrients are carefully measured based on plant type and quantity, over fertilization results in smaller yields so only the necessary amount is used. Traditional agriculture consistently over fertilizes resulting in nutrient runoff which causes algae blooms and kills aquatic life. All the nutrients plants need to grow must be in the solution because there is no soil used. However, the most needed nutrients, Nitrogen, Potassium, Phosphorus, Sulfur, and Oxygen, as well as trace elements like Calcium, Copper, Zinc, Molybdenum, and Iron do not need to be added as pure chemical fertilizer. These nutrients occur in already occurring waste streams, one of the best suited for indoor applications is fish farms.

Farmed fish and shellfish require a constantly filtered water supply to remove feces and waste from the environment. Normally this waste is filtered and removed

[34] Frazier, Ian. *"The Vertical Farm: growing crops in the city without soil or natural light."* The New Yorker. Janurary 1, 2017

[35] Jones, Benton J. *Efficiency is the future of hydroponics.* Hydroponics Articles, Garden and Greenhouse. May 2014

from tanks, but the waste includes the same nutrients that plants need to grow. When the wastewater from fisheries is filtered through plants, an Aquaponic system is created. This symbiotic system improves upon hydroponics by providing a natural organic nutrient source, it also improves upon traditional fisheries by providing a natural filter for waste. Aquaponics is a complete miniature ecosystem where the only input is fish food, often vegetable scraps. Solid waste from fish can be filtered out in the growing medium of hydroponic systems and includes many essential nutrients. The ammonia produced by fish is broken down by bacteria in the water into absorbable nitrogen for the plants. This system is scalable and can be used in a home aquarium or a commercial fish farm. In a commercial application, this is ideal because it produces produce and protein in a zero waste, zero added chemical environment.

Fish waste is not the only animal waste used for agriculture. It is conveniently already suspended in water, but chicken and pig farms can also be integrated with dense urban agriculture. Despommier describes the ideal vertical farm as including chickens and pigs, who feed off of produce clippings and produce vital fertilizer[36]. Other theoretical projects place pig farms in urban towers, like MVRDV's Pig City. The Pig City project envisioned several open-air towers filled with pigs. Utilizing EU organic farming and animal welfare guidelines, pig farming processes are integrated and stacked to save space for other uses. Manure is centrally collected and used as fertilizer, and the pigs live in small groups on each floor rather than in one large pack.

[36] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 33

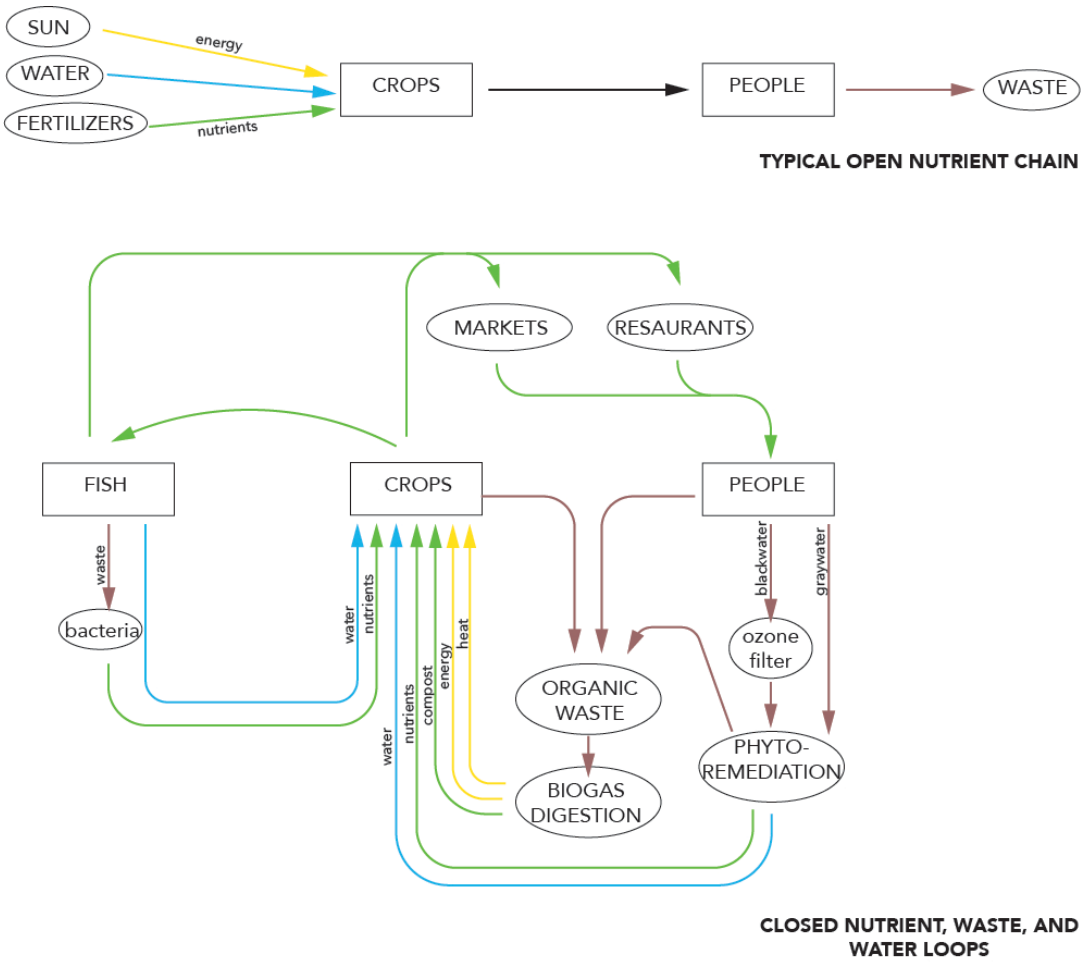
The firm developed this theoretical project in response to growing concerns about the spread of disease is factory farms, and the realization that there are nearly as many pigs as people in the Netherlands, and each pig, under EU guidelines, requires more space than a human[37]. Pork production, packaging, and distribution facilities are located at the ground floors of each tower, integrating the meat system. It is unclear whether the towers also include vertical fodder farms that use pig waste as nutrient inputs.

Another source of available nutrients comes from municipal waste. Throughout the world, sewage is used to fertilize farmland. In developing countries, this is often untreated and poses health risks, but it is possible to pre-treat raw sewage to remove harmful parasites and microorganisms while leaving available nutrients for crops. Older cities like Baltimore have ailing sewer systems that often result in sewage overflows into urban streams and the harbor making waterways unsafe. Baltimore has a $400 million dollar plan to improve the sewer system to prevent these overflows, after already spending $700 million in the last decade[38], but another helpful solution would be to not contribute to the public sewer at all. Wastewater can be filtered onsite through several methods utilizing plants to filter the water. A common solution is the constructed wetland like that developed as a centerpiece at the Sidwell Friends School in Washington D.C. The same processes, however, can be used in conjunction with hydroponics. Wastewater that is treated with ozone is

[37] MVRDV. "Pig City."

[38] Wheeler, Timothy B. *No end in sight for Baltimore's $1.1 Billion overhaul of leaky, polluted sewers.* September 19, 2015

free of disease-causing microorganisms and extra-oxygenated[39]. The oxygen and nutrients available from waste can be used as vital inputs for hydroponic and soil-based plants. Soil based plants watered with treated wastewater grow better than those watered with drinking water, the waste is free fertilizer[40]. Hydroponic plants are normally fed a chemical solution of nutrients that are abundant in wastewater. In order to remove harmful heavy metals that may appear in wastewater, the water can



20: Open vs Closed Nutrient, Water, and Waste Loops. Author

[39] Rojas-Valencia, M.N, M.T. Orta de Velásquez, and Víctor Franco. "Urban Agriculture, Using Sustainable Practices That Involve the Reuse of Wastewater and Solid Waste." *Agricultural Water Management* 98, no. 9 (2011): 1389

[40] Rojas-Valencia, M.N, M.T. Orta de Velásquez, and Víctor Franco. "Urban Agriculture, Using Sustainable Practices That Involve the Reuse of Wastewater and Solid Waste." *Agricultural Water Management* 98, no. 9 (2011): 1392

be phyto-remediated by fast-growing marsh plants like cattails and sawgrass before being used for agricultural purposes. The marsh plants can be harvested regularly and used to create energy through biogas digestion[41]. Integrating vertical farming with the waste streams of the surrounding area can create a symbiotic zero-waste community, removing undue stress on aging sewer systems.

Benefits

The benefits of urban agriculture are clear. Awareness of food, nutrition, and health are brought to the communities that have the least access to fresh food. Food grown within city limits travels mere minutes to its destination, greatly reducing the carbon footprint. Urban gardens have the capacity to rejuvenate ailing areas of cities, turning abandoned land into an edible landscape. High-tech agriculture allows vastly greater yields of crops, and indoor farms allow stacking of farmland into towers with ideal conditions for year-round harvests. The integration of waste and water streams from farmed fish and shellfish, as well as municipal gray and blackwater, into food production make zero-waste systems possible. The density of vertical farming makes compost collection and biogas generation easy. To further these benefits, pairing food production with a public marketplace, the historic cultural and social hub of the city, makes a vibrant mixed-use neighborhood possible where people not only live, work, and shop, but grow, cook, sell, eat, and share food. Vertical farming makes it possible to have a waste and water neutral community.

[41] Ellingsen, Eric C., and Dickson Donald Despommier. "The Vertical Farm – The Origin of a 21 St Century Architectural Typology." *CTBUH Journal*, no. 3 (2008): 35

Chapter 4: History and Context

The Arc of History

Lexington Market was founded in Baltimore just before the official end of the Revolutionary War, as America's first public market. The marketplace grew from an impromptu collection of wooden stalls to a large covered shed. It then grew to three shed buildings each a block long, transformed to a block-sized warehouse, and finally after 200 years became the market all Baltimoreans know today—brick warehouse, glass arcade, and parking garages.

That is not to say that the evolution of the marketplace has been one of steady growth, the market's identity is both singular and closely linked to the surrounding neighborhood, Westside, in downtown Baltimore. Like many downtowns, Baltimore's has seen waves of growth and health mixed with extreme decay and abandonment. Westside and Lexington Market became the commercial core of the city in the late 19th century but suffered enormously in the mid 20th. Urban renewal projects starting in the 1960's have breathed new life into parts of downtown, but Lexington Market sits isolated, surrounded by disuse and vacancy. It is a reminder of a time long ago when this was the heart of the city.

Founding

The market on Howard's Hill began in 1782 with a decree from the state legislature and a tract of donated land. It was designated on a site on an unnamed street at the fringe of Baltimore to be easily accessed by farmers from the region[1]. The street on which it sat was quickly named Lexington after the Revolutionary War

battle a few years prior, and the name "Lexington Market" followed. It began as a marketplace for farmers in the local area to sell goods, and as Baltimore City grew, so too the demand and thus the number of purveyors. Farmers came from the eastern shore, western, and southern Maryland to sell their goods three days a week.

For the first several years, the market was merely a place, not a building. Farmers built stalls for themselves on the hill and filled the shelves on market days. Around 1800 the first shed building was built, to organize the vendors and keep out the rain. In 1818 the first addition was built, and by 1900 there were three block-long shed buildings featuring fold-up exterior walls, and more than 1,000 outdoor stalls lining the surrounding streets for blocks. At the turn of the century, Lexington Market was the largest in the world[2].

The Market was intended as a public amenity, a source of inexpensive food for city residents, and a place for farmers and producers to deal directly with consumers, not mediated through middlemen and distributors who gouge consumers and cheat the farmers[3]. As early as 1860 the state legislature saw the benefits of farmers dealing directly with consumers and passed an act preventing farmers from being charged a fee to operate a market stall[4]. The market started as a local producer's only market, meaning only from local farms and only sold by the farmers directly, but commercial pressures in the mid 19th century and the sudden availability of fresh goods by train or steamship from far away lead to an integration of professional retailers into the market. These vendors sold produce from the deep south, oranges from Florida, bananas from Central America, and other faraway goods amidst the local farm and butcher stands. A report from 1913, the market's busiest

era, states that only 10 percent of the stalls at Lexington Market are bona fide farmers, the rest are retailers[5].

Figures 21, 22: Fold-up walls of original Lexington Market, the market with street stalls in Eutaw St. Schultheis, Patricia. Baltimore's Lexington Market. Images of America. Charleston, SC: Arcadia Pub, 2006. 28, 32

At this time, large grocery stores began to appear and hurt market business, though the prices, freshness, and quality of goods at the market could not be beat. In fact, many famers would sell their unsold goods to the grocers after market days[6]. Having a stall at Lexington Market was a point of prestige. The right to have a stall

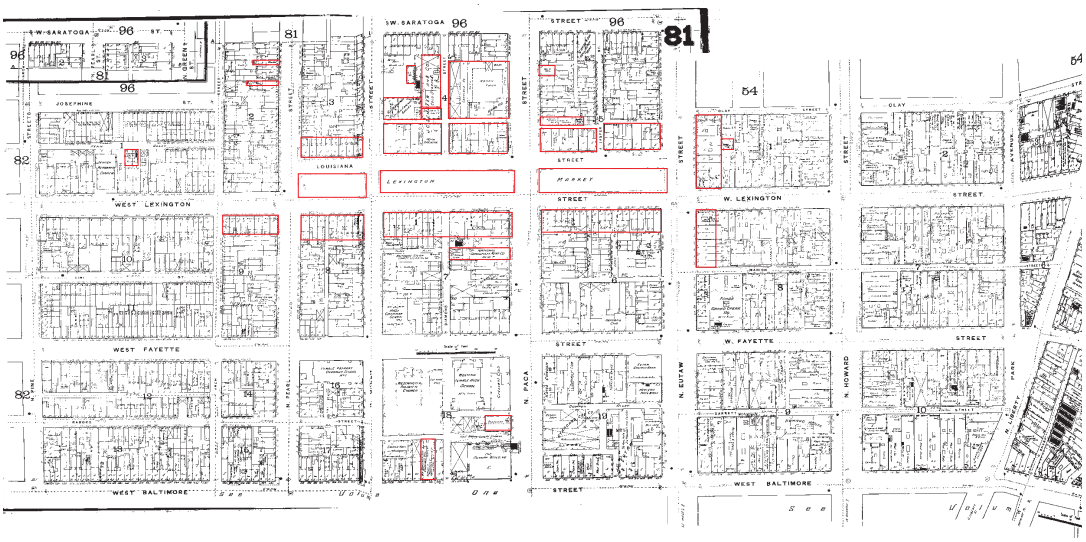


Figure 23: Lexington Market with associated retail businesses, 1890. Sanborn Maps compiled and edited by Author

was passed down through generations like property rights, and unlicensed "hucksters" were strictly forbidden from selling produce within five blocks of the market[7].

Heyday

Baltimore grew as an industrial city in the early years with sailcloth being one of the quintessentially Baltimorean exports. Westside was developed as a factory district, spinning and sewing sailcloth in large brick warehouses near the harbor just south of the market. The area directly around the market grew in a much different way. The market became a development stimulus, creating a need for stables and inns for stall-keepers, and attracting more permanent shops, bakeries, and distributors[8]. As the city grew, the market itself grew from one shed, to three, and on market days expanded into the streets, connecting with Charles Street, three blocks to the east, and Pratt Street, three blocks to the south. This consumer center attracted the

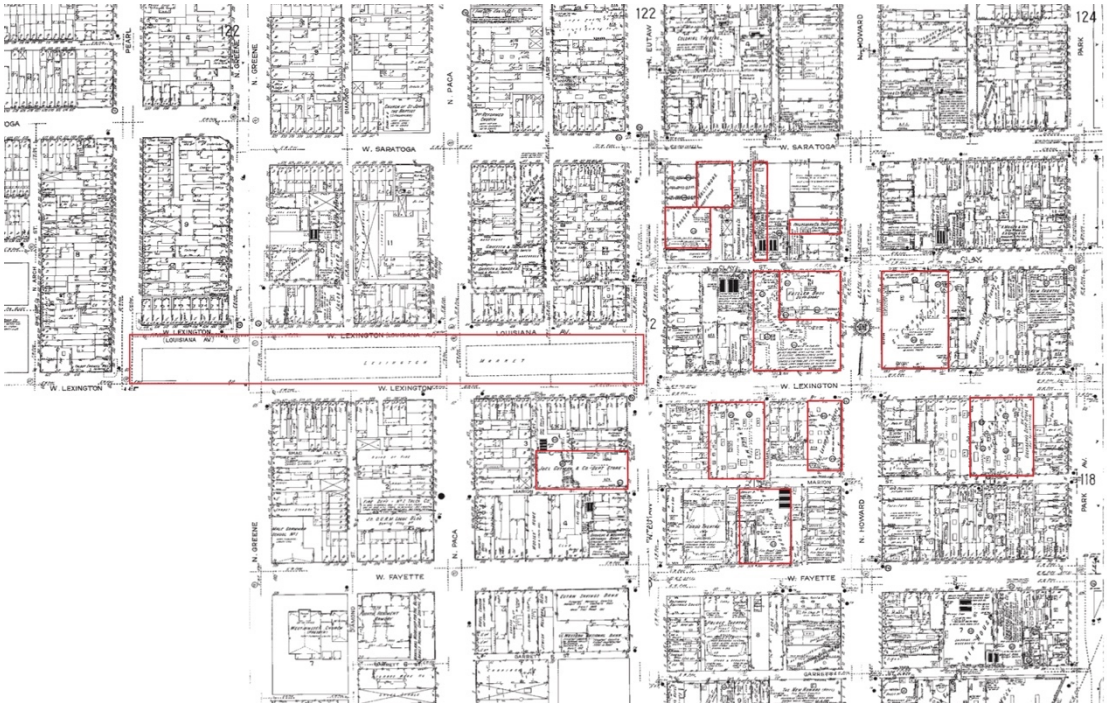


Figure 24: Lexington Market with major department stores, 1914. Sanborn Maps compiled and edited by Author

first department stores in the city in the late 19th century, and by the 1920's a vibrant shopping district had emerged on the blocks just to the east of the market[9].

The corner of Howard Street and Lexington was the epicenter of retail, with four major department stores and the flagship Read's Drug Store. These stores and Lexington Market were complimentary, creating a shopper's paradise. The market had every foodstuff anyone could want, department stores stocked clothing furniture and household wares, and the drug store housed a restaurant with live jazz, a soda fountain, café, and lunch counter in addition to its famous pharmacy[10]. A diversity of uses, all focused on providing goods and services to city residents made this a vibrant and healthy commercial core.

Market System

Lexington was the first of many public markets. Ten smaller neighborhood markets were built before 1900 each serving an individual neighborhood like Canton, Federal Hill, or Fells Point. Lexington Market was the central market, and by far the largest, a destination spot[11]. Only 5 neighborhood markets remain today, and of them, only Cross Street Market in Federal Hill retains its vibrancy and character.

At the turn of the century there were several other markets not owned by the city. These were not neighborhood markets, they did not focus on the consumer, but rather the opportunity to sell wholesale directly from trains and boats. These markets were at the old Mount Royal Station in Bolton Hill (now part of the MICA campus), at Camden Yards Downtown, and at the municipal docks in the harbor, and sold

produce directly from the train cars and ships they were delivered on[12]. It is interesting to note the fundamental schism between these markets and the original dogma of Lexington Market, what is now the difference between the supermarket and farmers market. One is based on fresh local goods from an array of producers, and the other on mass-produced and shipped goods from all over the world sold through an intermediary.

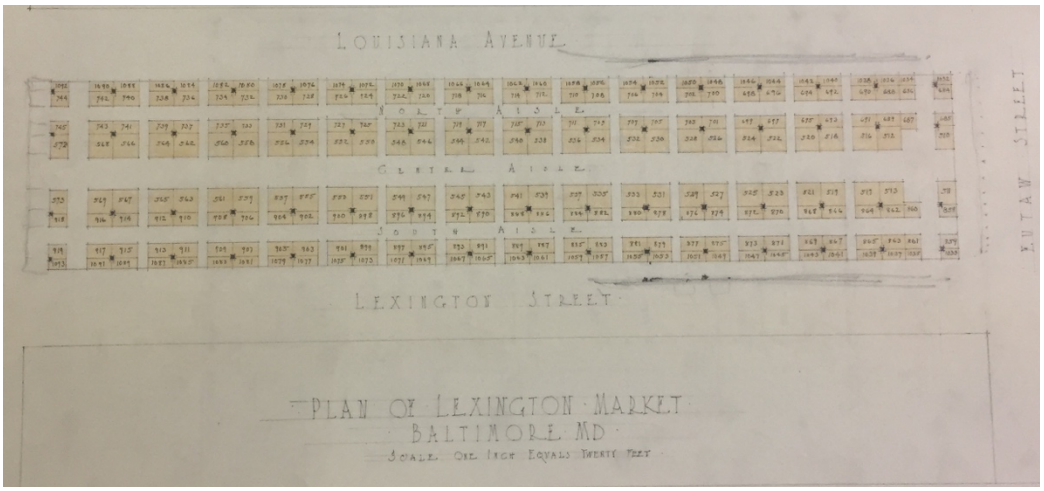


Figure 25: Lexington Market stall layout (Main Building) 1914. Unknown, accessed and photographed by author at Baltimore City Archives 03/15/2019

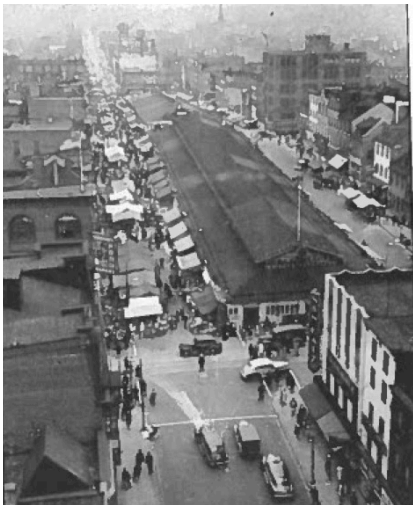
Most of the public markets in the Baltimore system take the original shed building form in the center of an enlarged street—the street market house. This provides opportunity for porosity through the market and surrounding street frontage to compliment market activities. The market in Canton is long gone, but the space it occupied is now a public green surrounded by shops, bars, and restaurants and is still a public node in the neighborhood. The Broadway Market in Fells Point and Cross Street Market in Federal Hill are much the same, with bustling streetscape all around. Both these markets are in the midst of major renovations to return them to a useful state and let the symbiosis of market, bars, and retail shops return.

In the last few years, new private markets have appeared in Baltimore, but are very different from those of the last century. The new markets—Mount Vernon Marketplace and R House among others—are food courts. The public markets today, Lexington included, are mostly food courts as well. However, city sponsored weekly farmers markets pop up in plazas, parking lots, parks, and under the highway downtown. Food and goods sold by local producers has migrated out of the market buildings and into the street in these weekly events. The market's themselves are mainly repositories for tiny restaurants and bars, existing in a collaborative and beneficial space.

Exodus

The commercial core of the city, anchored by Lexington Market and Howard Street's department stores began its decline in the 1930's. The Great Depression lead to the first big department stores closing, but the largest influencer of change was automobiles. The increasing importance of the automobile, suburbanization, and white flight all lead to the demise of the downtown shopping district, leading to the shuttering of the department stores, and dramatically fewer visitors to the area[13]. Automobiles gave people the ability to drive longer distances to get to work, to live in the suburbs, and shop in suburban shopping malls with expansive parking lots. There became no need or want to go downtown, or to live there, when the large houses and open spaces of the suburbs were so readily available. This drove down business for the market as well as department stores. Grocery stores may not have had the variety

or prices of the market but could be accessed quicker and easier. Moreover, this wasn't the only auto-related problem facing the market. The increase of traffic on the roads downtown was at direct odds with the street stalls of Lexington Market. The stalls impeded traffic and were eventually banned in 1941 to make way for vehicle traffic, removing the street presence of the market. There were only 80 stalls at this time, down from the nearly 1,000 that existed in its heyday[14].




ORGES MAYOR
REMOVE STREET
MARKET STALLS
EVE. SUN
Junior Commerce Group
Also Appeals To Fire
Board President
JUL 28 1939
Calls Stands On Eutaw
And Lexington Streets
Deplorable Hazard

Figures 26, 27: Street vendors clogging the street adjacent to Lexington Market, Baltimore Sun headline July 28, 1939.
Schultheis, Patricia. Baltimore's Lexington Market. Images of America. Charleston, SC: Arcadia Pub, 2006. 40, 48

Suburbanization, of course didn't just affect the market and commercial core, but all of downtown, leading to a series of urban renewal projects in the mid and late 20th century.

Rebirth

In 1949 the main market building burned to the ground, destroying 186 stalls and damaging nearby buildings. The market was quickly reimagined in the early

1950's and transformed from large shed buildings with frontage on all sides, to a nearly windowless brick warehouse and 1,000 space parking garage. By this time nearly all the farmers and actual producers had left and the market was populated by middlemen retailers and short-order restaurants. Grocery stores provided most daily items and patrons came less frequently for specialty goods or out of tradition. The design was heralded as visionary for rethinking the organization of markets but is clearly based on accommodation of vehicle traffic. The building moved out of the street to fill an adjacent block, and another entire block was demolished for the parking garage.

The original shed buildings were porous, the long walls folded up to become awnings on market days, giving street presence to the exterior stalls and opening up numerous entrance aisles to the center. Street stalls lined the streets outside of the market buildings and lead to the market from blocks around. Stalls inside were organized hierarchically in rows with a large central aisle and two smaller edge aisles, stalls were grouped in fours and each had corner frontage with one side on a main aisle. After the fire a temporary structure was built to house the market while a permanent solution was sought. An aluminum hangar replaced the building in size and scale but was lacking the right attitude. It was closed off from the street, dark and dreary, and not good for business[15]. It is surprising then that the new building designed to replace the street market houses, now called the East Market, suffers from the same atmospheric issues.

A block-sized brick warehouse was designed, with few doors, fewer windows, and a confusing layout. The new building organized stalls in a matrix with no clear

hierarchy. Stalls are in a seven by nine grid, making it near impossible to find anything without the bright neon signs that proliferate throughout. The market can be entered by three main entrances, series' of double doors, but otherwise is completely cut off from the street by a tall brick wall.

Figures 28, 29: Lexington Market blank brick exterior, "The Arcade" at Lexington Market. Author

A glassy addition was added to the market in 1987, called the arcade. This addition took these faults and the historical context to heart, imitating the form of the original buildings over a block of Lexington Street, with ample natural light. The design takes inspiration from covered arcades and gallerias like those of Milan, Naples, and Manchester, and is intended as an interior street[16]. Today the arcade acts as the main entrance for the market, its only place to sit and eat, and a place for impromptu stalls and tables. The arcade was originally intended to have an interior greenhouse that could be seen from the street, bringing nature into the area.

Urban Renewal

After the precipitous decline in the health of downtown Baltimore, several urban renewal projects were implemented to bring back use and vibrancy. Several of those have affected Lexington Market and the immediate context. Development projects have improved pedestrian and public spaces, created retail corridors, improved transportation infrastructure, and allied with the arts in order to bring people back to downtown. Unfortunately some of these initiatives have focused attention away from the market, and have left it more disconnected than ever before.

Figure 30: Residential towers of Charles Center seen from Lexington Street. Author

Until the 1950's the corner of Howard and Lexington streets was still the retailing core of the city, along with Lexington Market and innumerable shops and theaters. If the initial hit to the area came through post-war suburbanization, the area was finally "bled dry" by the development of Charles Center in the 1960's and the Inner Harbor in the 1970's[17]. The Charles Center development project started in 1954

to try to fight the decline of the retail area. It succeeded in bringing people to downtown, but not to the old hub in Westside. Flashy new buildings, like the Mies van der Rohe tower, and a large pedestrian plaza enlivened the project area and cut off Westside. The plaza took over a block of Lexington Street, physically cutting off a main thoroughfare to the market.

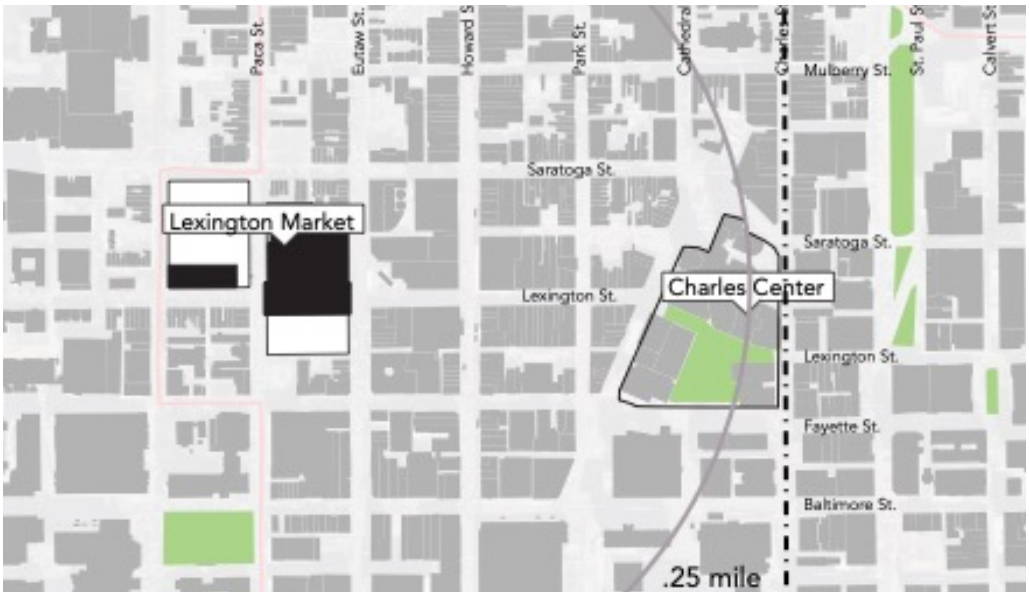


Figure 31: Proximity of Charles Center and Lexington Market. Arc GIS modified by Author

The Inner Harbor development that started in the 1970's and continues today has drastically changed the industrial port into a retail and tourist hub, but again, this development favors the new while abandoning the old shopping area.

In 1979 the Market Center Development Corporation of Baltimore (MCDC) was created to try to turn the market area around. The main components of their plan were to incrementally rehab buildings, one at a time, to garner interest, and to revive the area by attuning new development to the history of the place. Their stated objectives were to first improve the physical appearance of the area, which had become extremely run down due to vacancy, and to create the climate for mid-scale shopping by improving transportation and bringing people to live in the area[18]. The

old garment district warehouses to the south of the market were converted into loft apartments with easy access to the inner harbor. Their plans for a Lexington Market addition, "The Arcade," were described previously, referencing the historical context. Additionally, a new post office branch was erected on the site of the third original market building between Greene and Pearl Streets and takes the form of a market shed.

The improvements in mass transit happened in the early and late 1980's, with the city's only metro line opening in 1983 with a stop directly across from the market, and the city's only Light Rail line opening in 1992 with stops all along Howard Street downtown. The initial MCDC plans for the Lexington Market expansion included a metro entrance inside of the market, but that integration was never realized. The MCDC had planned a million square foot federal office building over the existing

Figure 32: Historic facades of vacant buildings on Howard Street, part of the "Superblock". Author

market parking garage to use up available FAR and bring a large customer base directly to the market, but that of course was never built. A pedestrian mall on Lexington Street was planned to connect the new market arcade with Charles Center and the remaining department stores on Howard Street into one large walk-able retail area, but again was never realized[19].

More recently, revitalization efforts have focused on a large-scale demolition and replacement project dubbed the Baltimore Superblock. The project was announced in 2004, and all the existing small businesses on Howard Street and the rest of the development area shut their doors and moved out, thinking that their stores would be bought out and razed soon for the project[20]. The project was delayed several times due to a lack of understanding of the importance of architectural charm and generally poor planning.

The superblock was finally abandoned in 2016 as several properties of the development area were bought and redeveloped piecemeal, as had been suggested by the ULI and others as a more beneficial development strategy all along[21]. The scars of the superblock are still present in the vacancy of the historic buildings of Howard Street, but the regeneration of the area, one property at a time has begun in earnest with the creation of the Everyman Theater (formerly the Palace Theater) among others in the area.

The most recent redevelopment stimulus has come not in the form of an overhaul, but in a framework to encourage residents and visitors to the area. Lexington market, the historic retail core of Howard Street, and the immediate area have been classified as of 2012 as part of the Bromo Tower Arts and Entertainment

District. This is Baltimore's third Arts District, first pioneered in Station North near Penn Station two decades ago. The arts district designation encourages development through tax breaks for building rehabs, for creatives living within the district bounds, and for arts related businesses. It also encourages public art and community development. The district is anchored by the Hippodrome Theater, and by its namesake the Bromo Seltzer Tower, which has served as artist studios for years.

The impetus for creating arts districts came from a desire to fundamentally change the demographics of Baltimore. The city, like many post-industrial sites, had the image and infrastructure of a bygone era as the world moves on. Around 2000, the urban theorist Richard Florida was a consultant for the city, where he advocated catering to the "creative class"—a term he coined—in order to stimulate the city. Instead of investing in manufacturing or large corporations, he thought post-industrial cities should create places for creative people—artists, musicians, architects, engineers, entrepreneurs, tech developers, and most importantly young people. This "creative class" will enliven the city through galleries, theaters, restaurants and the like, and spend money at small businesses. This initial revitalization will then attract larger development and a demand for housing in the area[22]. After seventeen years, Station North is now home to both underground arts spaces and a tremendous amount of new development as the neighborhood has transformed. The current demographic of the Bromo Tower arts district fits this creative class demographic, mostly single, childless, and with expendable income[23]. A redeveloped market would be wise to consider both food and opportunities for the arts in the area.

Westside Today

The neighborhood has grown and become habitable in places, but the historic core remains vacant and is often physically deteriorating. Empty shells of theaters, hotels, and department stores line Howard Street and the Superblock. The vacant buildings are for the most part beautiful, with cast iron facades or art-deco detailing. Preservation of the historic architecture of Westside has been a stumbling block for many potential developments.

Figures 33, 34, 35: The abandoned Mayfair Theater on Howard Street, a poorly retrofitted grand façade on Howard Street, Art Deco detailing on Lexington Street. Author

Lexington Market Today

Today the market is more than a third vacant, and nearly all vendors sell fried food and candy instead of fresh meat and produce. The abandoned department stores loom nearby as reminders of a time when downtown was the epicenter of commerce. It is ironic that nearby areas are designated food deserts when the theoretical ability to have abundant fresh food is so close.

Figures 36, 37: Vacant food stalls in Lexington West Market, dark maze of Lexington East Market seen from stair mezzanine. Author

At its largest, in the decades prior to WWI, Lexington market had nearly 600 indoor stalls and 1,000 outdoor stalls that stretched for blocks throughout downtown serving 50,000 people a day. Today there are 62 occupied stalls. Of those, two are dedicated to produce, two to fresh seafood, and seven are butchers. The last bona fide producer left the market in 1985[24], and since then most of the market stalls resemble bodegas. A "bakery" stall resells cheap white bread; a meat stall called "Brookdale Farms" resells Perdue chicken. The market no longer serves the public as a place to source fresh, local, and inexpensive food; neither does it

provide the eclectic, well-made dining options that are a staple of new food court markets in the city. Lexington Market needs a new vision in order to live up to its name.

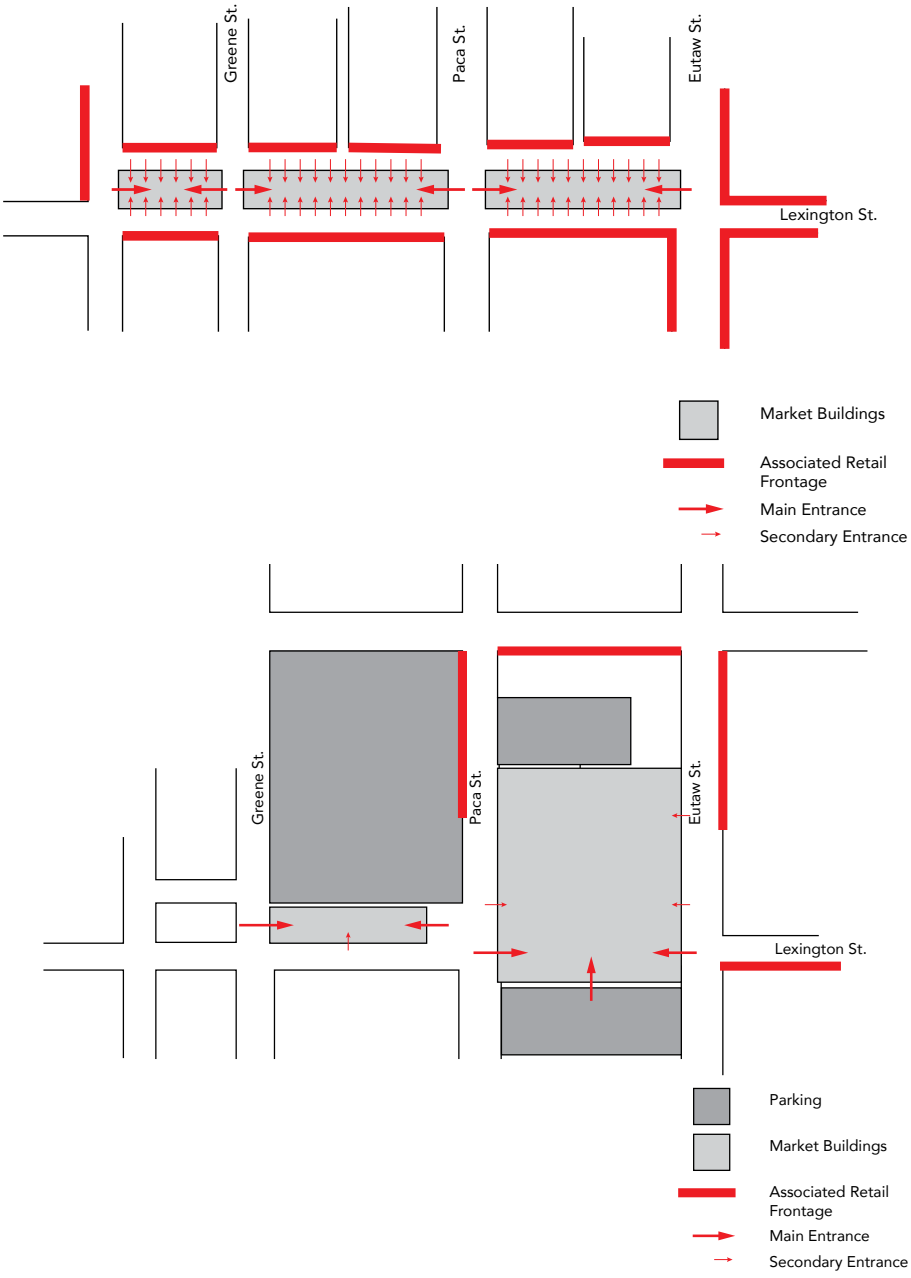


Figure 38: Comparison of historic and current Lexington Market with regard to porosity and retail frontage. Author

Chapter 5: The Site

Analysis

Baltimore's food deserts ring the inner city, even bordering on Lexington Market. The potential users closest to the market are in the most need of fresh, affordable food. Neighborhoods connected by mass transit are also in need of food security. A revitalized market, in addition to food access, can provide jobs, education, social and cultural programming for downtrodden communities.

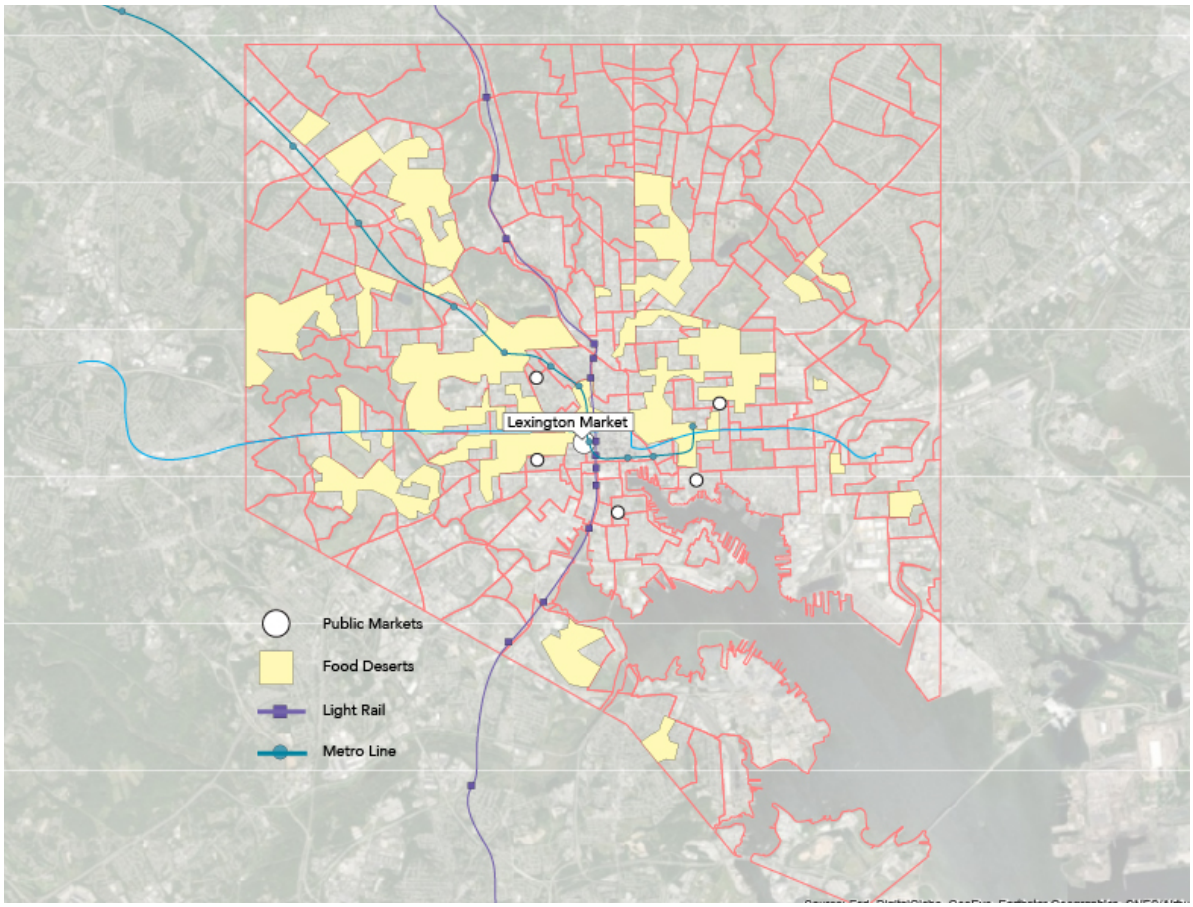


Figure 39: Food deserts in Baltimore with relation to public markets and mass transit. Arc GIS modified by Author

Lexington Market is a public node within the downtown core, closely bordering the University of Maryland Baltimore campus and the Charles Center. The Inner Harbor promenade is only a few blocks away, as well as large event centers like the Convention Center, Royal Farms Arena, and Oriole Park. Proximity to these hubs places the market well within reach of thousands of tourists and visitors as well as local residents.

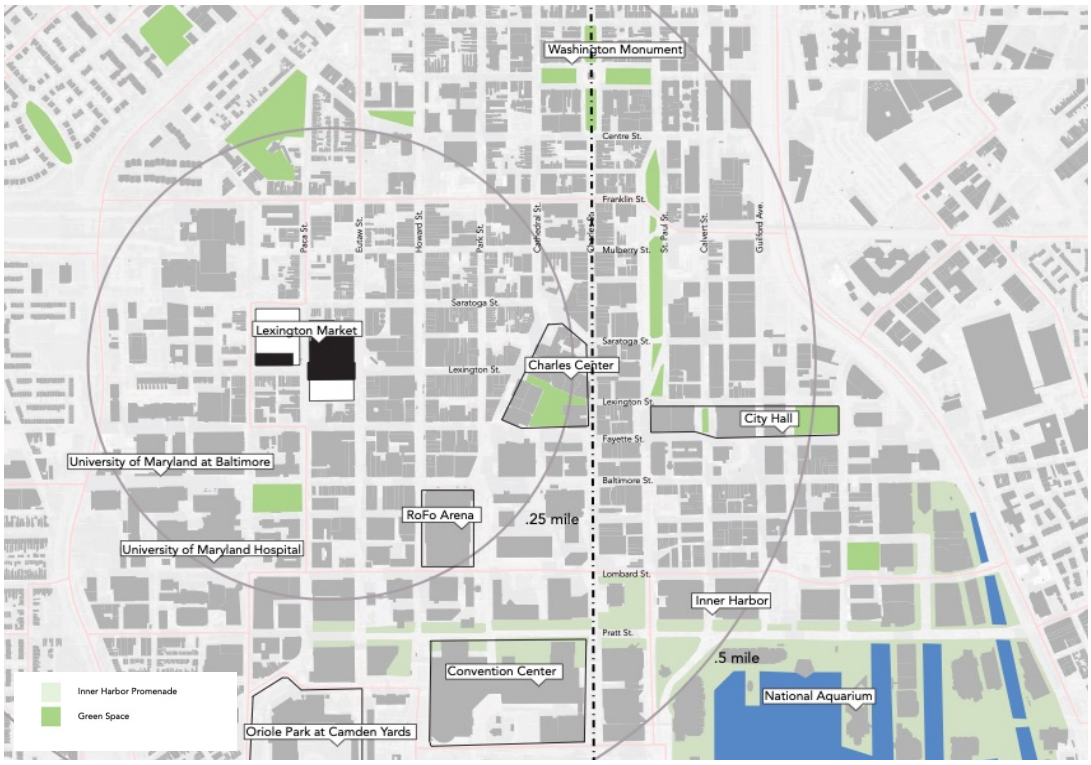


Figure 40: Points of interest near Lexington Market. Arc GIS modified by Author

Existing in the heart of downtown means the site is extraordinarily well connected, and potential users are always nearby. Both of the city's mass transit lines pass within a block of the market, though ridership is quite low due to the disconnected nature of the routes. Several public bus lines approach the site, both the free Circulator and the Link, connecting every corner of the city, and especially downtown.

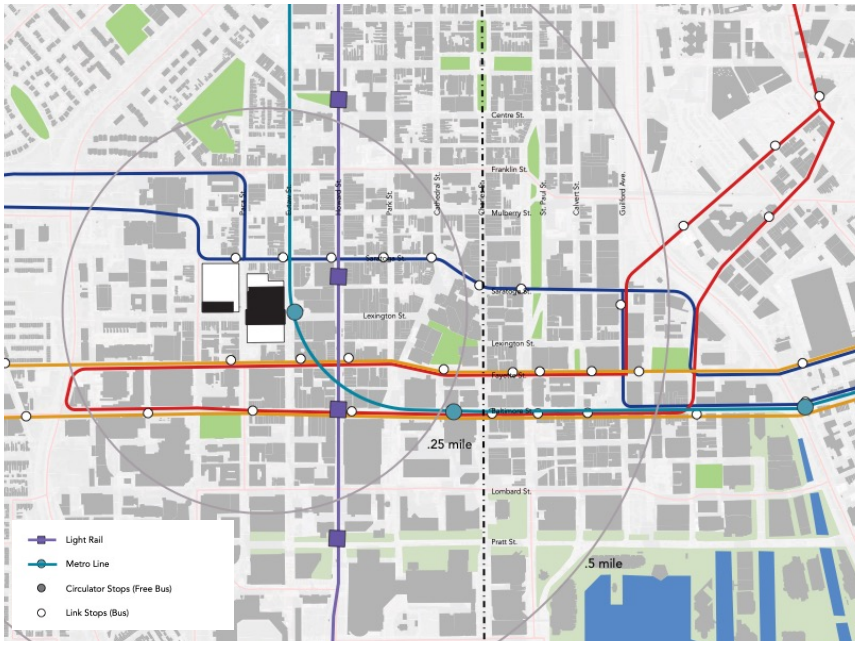


Figure 41: Transportation routes approaching the market. Arc GIS modified by Author

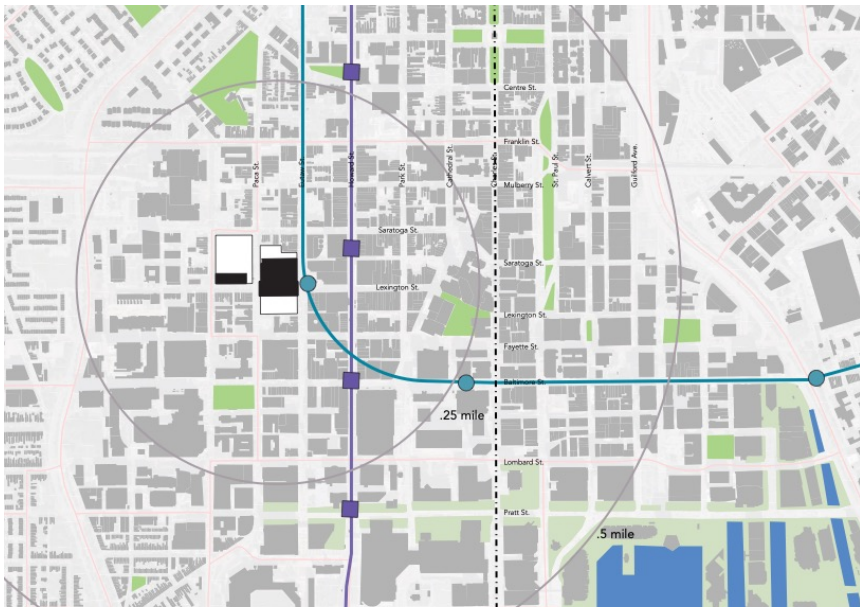


Figure 42: Light Rail and Metro lines. Arc GIS modified by Author

Several other markets exist in the downtown area. Three weekly farmers markets operate between April and December, the largest by far being the Sunday "Farmers Market and Bazaar" under I-83 on the East side of downtown. There is great potential to integrate the weekly farmers market with the daily public market to create a true market center.

A single grocery store exists in downtown, in Charles Center. As more people start to live in the downtown core, more food options will be needed.

Just to the North of the site, Mount Vernon Marketplace serves up a variety, with more than a dozen small restaurants with communal seating and an active social atmosphere.

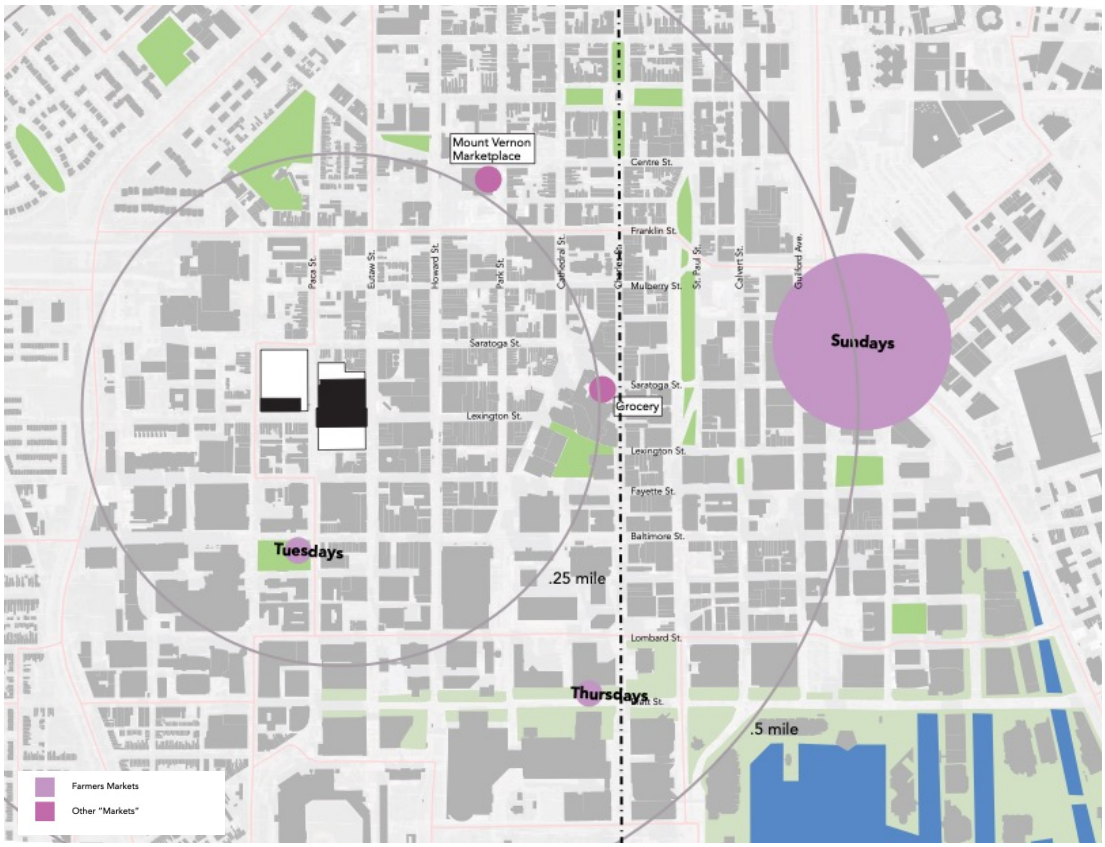


Figure 43: Farmer's markets, grocers, and food halls in Downtown Baltimore. Arc GIS modified by Author

The Market is bordered on the West by the University of Maryland Baltimore campus. The campus creates a dead-zone between the market and the residential areas beyond. The campus is professional graduate programs and a university hospital, meaning there are few students living on campus and these blocks do not have active streetscapes. Just beyond this zone is Martin Luther King Jr. Boulevard, a six lane expressway bypassing downtown that physically cuts off residential neighborhoods of West Baltimore from Downtown.

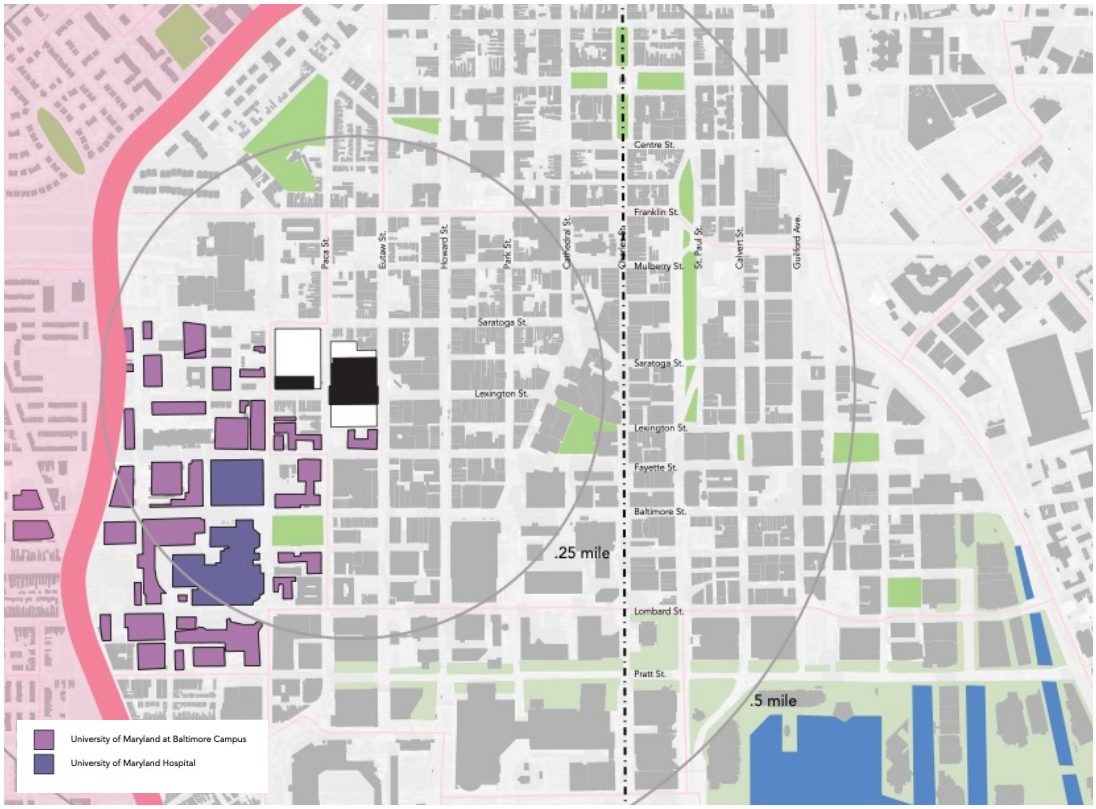


Figure 44: University of Maryland at Baltimore campus and MLK Jr. Boulevard hinder access from the West. Arc GIS modified by Author

There are numerous abandoned and vacant buildings surrounding the site and crawling up Howard Street. This is the ghost of the historic retail core of the city. All of these buildings, as well as Lexington Market and most of Westside are part of a historical district. The buildings in this area are often from the late 19th century and early 20th and feature beautiful ornamentation and detail. The area is home to the city's only cast-iron facades and is the only section of downtown that was spared in the Great Baltimore Fire of 1904—meaning it has some of the oldest buildings in the city. Urban renewal developments shifted attention to the South-East with the creation of Charles Center and the Inner Harbor and have left Westside untouched.

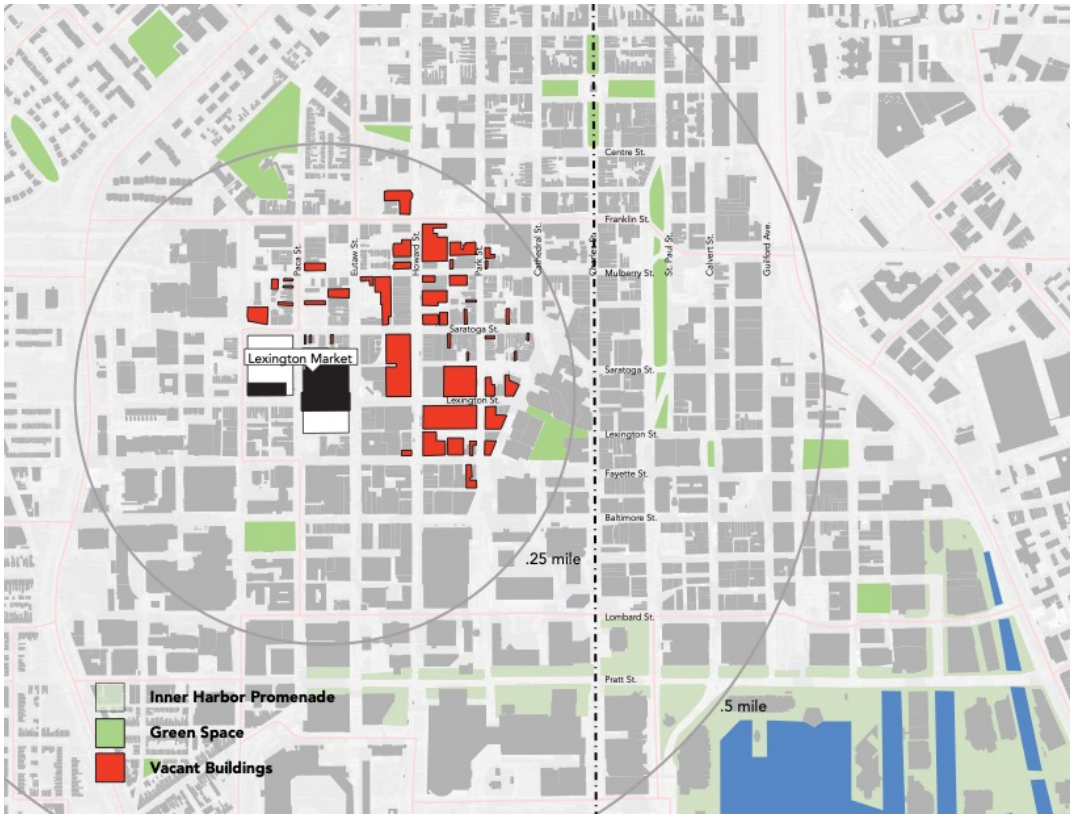


Figure 45: Vacant buildings to the East of the market. Arc GIS modified by Author

The market and the vacant buildings on Howard Street are also included in the Bromo Tower Arts and Entertainment District whose mission and effects have been described earlier.

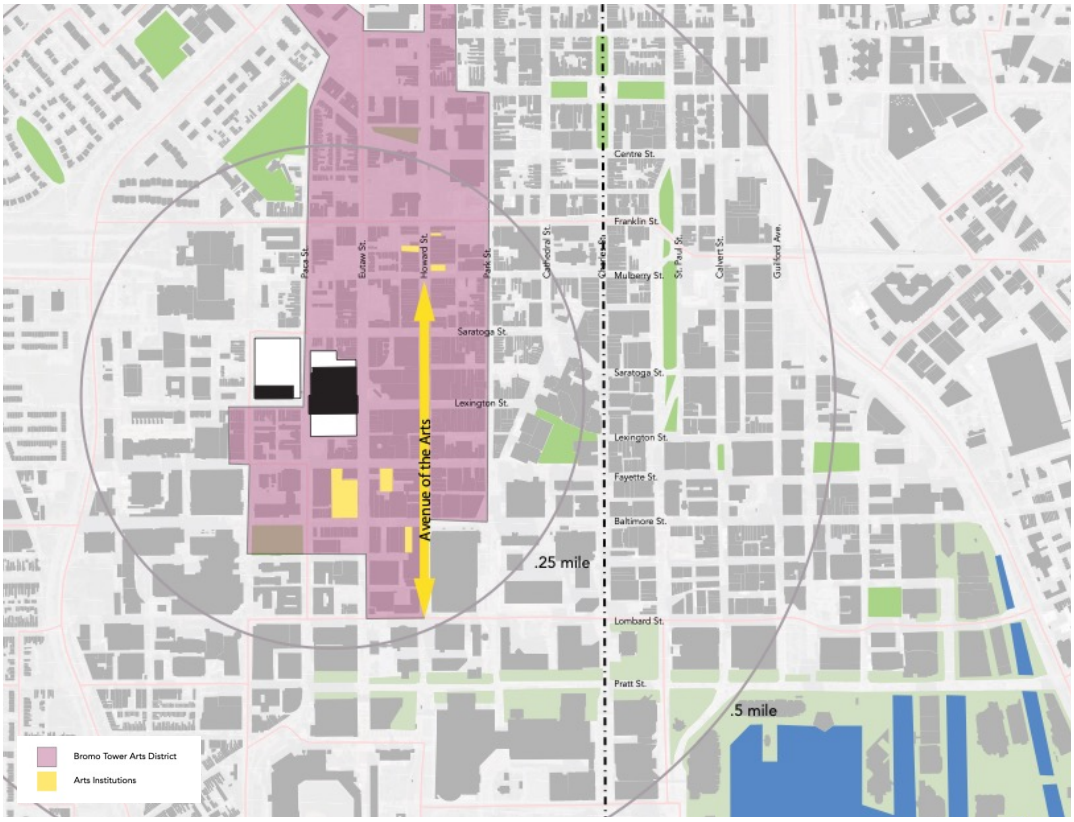


Figure 46: Bromo Tower Arts and Entertainment District with existing arts institutions. Arc GIS modified by Author

There is a cluster of residential buildings to the South of the site, either newer high-rises or converted 19th century warehouses. These buildings connect residents to the amenities of the Inner Harbor but are also well with a quarter mile radius of the Market. More residential buildings to the North border on the medium-density historic neighborhoods of Sutton Hill and Mount Vernon. The edge of primarily residential West Baltimore is nearby but separated from the market by MLK Jr. Boulevard and the UMAB campus.

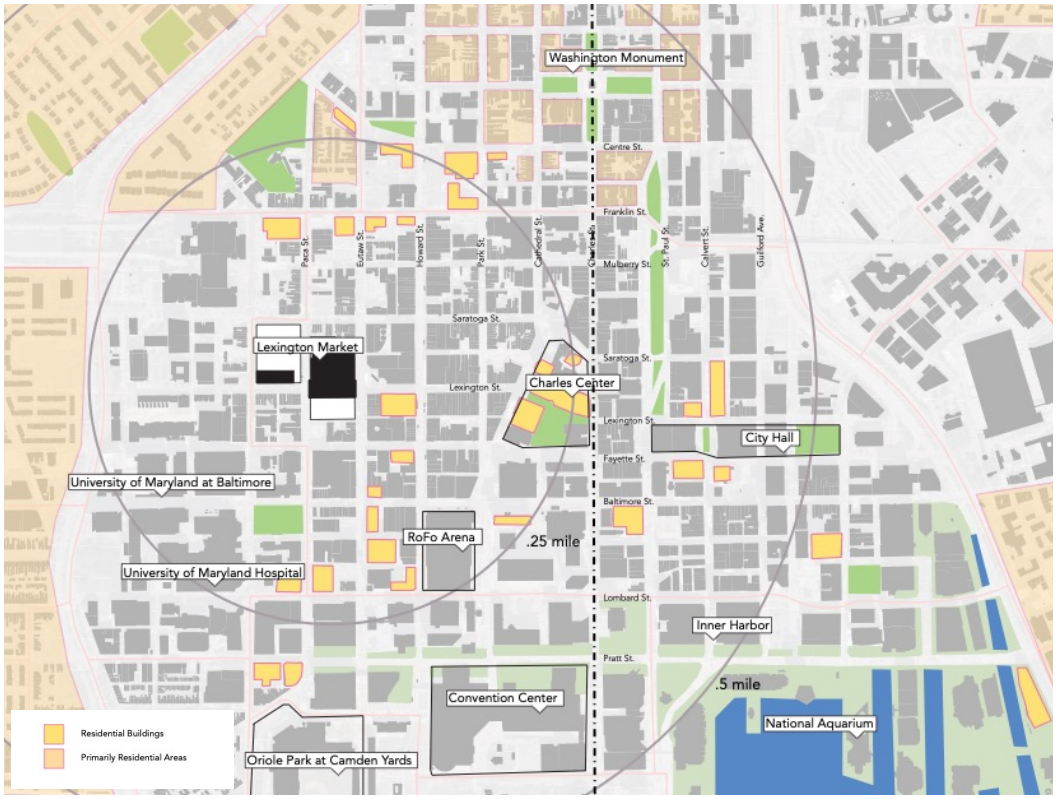


Figure 47: Residential buildings and neighborhoods. Arc GIS modified by Author

Lexington Street, once lined for blocks with temporary market stalls leading to Lexington Market, has been severed twice. The Charles Center cut off the street for a block, fundamentally separating the West and east sides of downtown, and obscuring the main approach to the market from Charles Street. The market itself occupies another block of the street, leaving behind a two and a half block stretch of Lexington between Eutaw and Liberty that goes nowhere. The heaviest density of vacancy in the area is on this stretch.

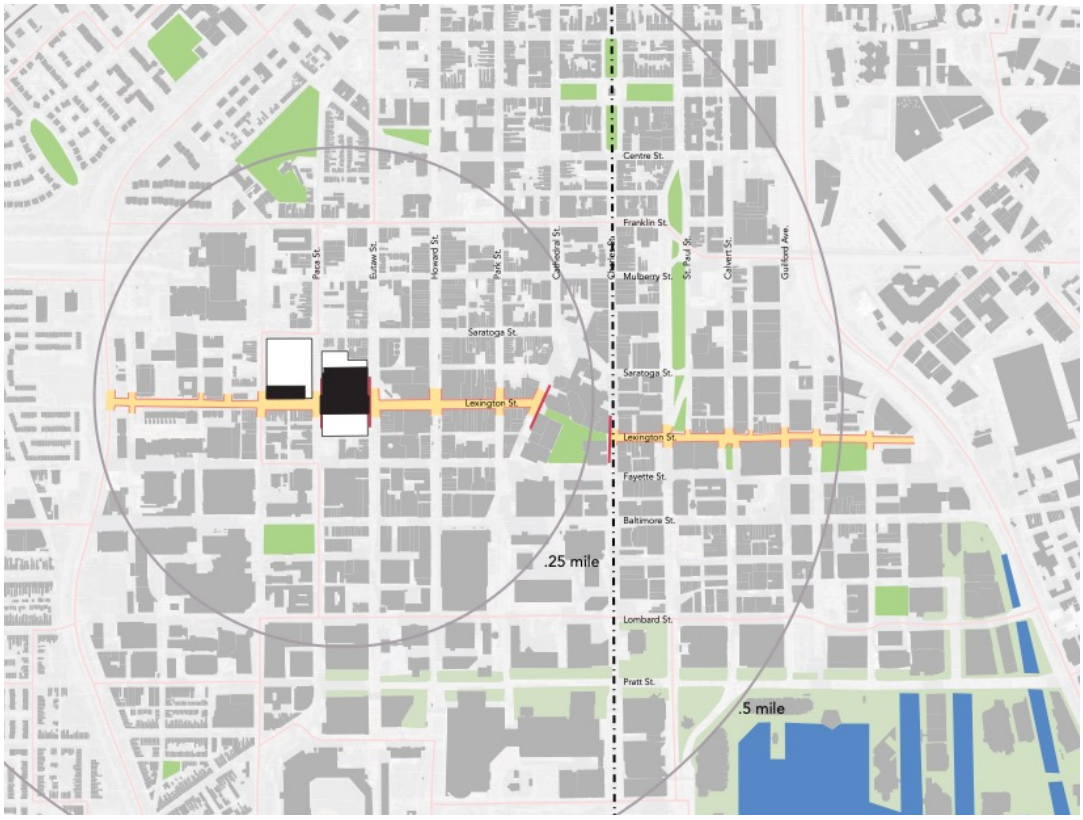


Figure 48: Discontinuity of Lexington Street. Arc GIS modified by Author

Lexington Market is currently underutilized and avoided. It is sandwiched between the inactive street-life of UMAB and the extreme vacancy of the historic retail district. Though it is well connected by public transit, there are few places to live in the immediate area. There is opportunity in its proximity to the Inner Harbor,

Charles Center, and large event spaces; also in the number of farmer's markets nearby that could be leveraged to bring users to the area. Inclusion in the arts district will result in slow, but steady and beneficial development.

The proposed site includes the entire market complex, and also the isolated section of Lexington Street and the vacant buildings surrounding—including the infamous Superblock. It is necessary to create a framework for the development of this site to provide the sympathetic land uses that a renewed market will need to survive. It is also the hope that the market will be a stimulus for urban development, reviving Westside and the rest of the Howard Street corridor and connecting with the activity of the Inner Harbor.

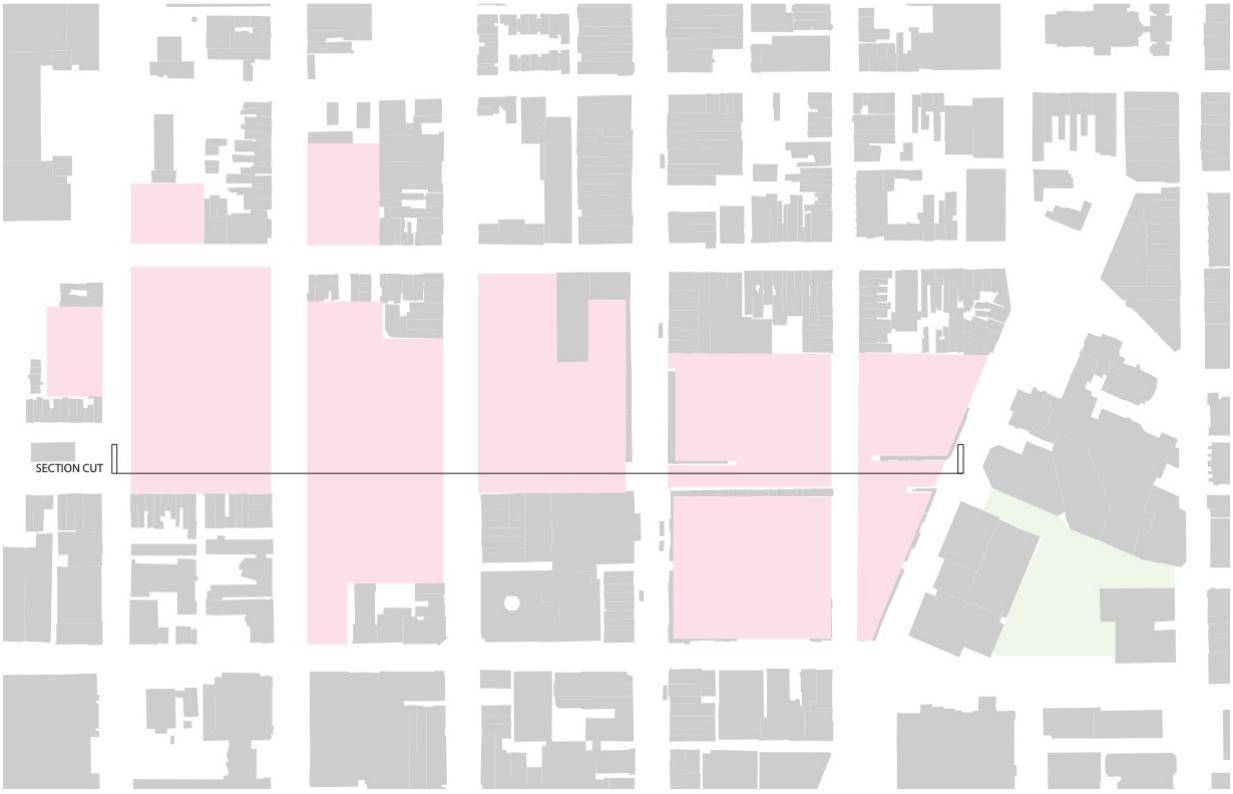


Figure 49: Effective site area. Arc GIS modified by Author

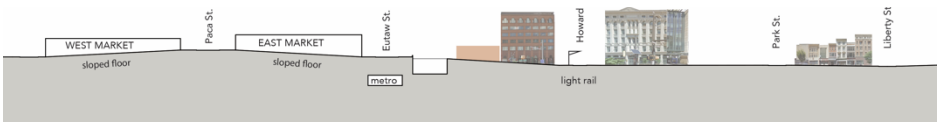


Figure 50: Site section in Lexington Street. Author

Chapter 6: Program

Introduction

In order to revive Lexington Market and Westside, the design incorporates three major program areas: the market, housing, and urban agriculture. Combining food production with retail has the opportunity to renew the public market as a source of fresh food for thousands as well as be a gastronomic hub and incubator of small businesses. It is necessary to include ample housing with the food-centric program in order to sustain a consistent user base and to activate the area beyond daytime hours. The program includes elements of both the historic public market and the markets of today, bringing producers and farmers together with restaurants and retailers to create a more holistic food-centric experience. By taking inspiration from the food cycle, a

Figure 51: User interaction of markets historically and today. Author

well-rounded food-centric program is exerted that responds to food at all stages, from growth to consumption, to conversion to reusable resources.

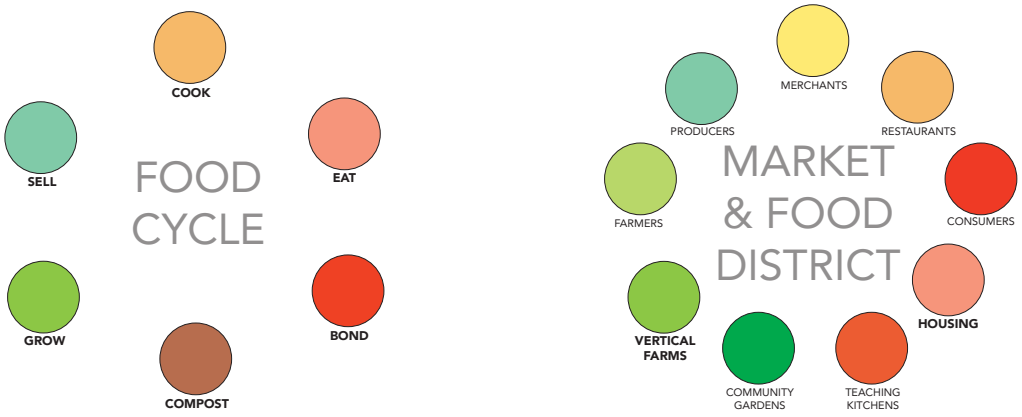


Figure 52: The food cycle as inspiration for basic program. Author

Market

The market is the heart of the design, combining public space and sustenance. Programmatic elements of a traditional market include stalls, restaurants, back-of-house service and production space, and eating areas. The design expands upon these necessary elements to include community-oriented spaces and to link the market to food production. Production kitchens for vendors are paired with teaching kitchens for public classes; indoor eating areas flow into outdoor seating areas, recreation space, and demonstration gardens; community meeting rooms offer space in a well trafficked central location. In addition to permanent restaurants and stalls, temporary vendors are allocated space surrounding the market, transforming public space during weekly events.

PROGRAM TYPE	UNITS	SF EACH	TOTAL SF	SUB TOTAL
MARKET stalls S	35	200	7000	
MARKET stalls M	25	400	10000	
MARKET stalls L	15	600	9000	
production kitchens	20	400	8000	
cold storage		1000	1000	
receiving area		3000	3000	
trash room		1000	1000	
compost collection		1000	1000	
recycling		1000	1000	
dining areas	15	400	6000	
admin common		500	500	
admin office	5	100	500	
MARKET (temp. outdoor)		100000	100000	
RETAIL	40	2000	80000	
teaching kitchens	2	2000	4000	
FOOD BANK		4000	4000	
NEIGHBORHOOD CENTER		7000	7000	
TRANSIT HUB		30000	30000	273000
mech. 6%			16380	
circ. 30%			81900	
				371280

Figure 53: Programmatic tabulation of market and retail space. Author

The market program can be categorized by three physical categories: the promenade, work space, and market landscape. The promenade includes the main circulation paths through the market, the stalls and storefronts. This experiential path is constantly in flux, expanding with temporary street vendors, and includes both indoor and outdoor space, eating areas, and social spaces. The market includes stalls at varying size to accommodate craftspeople, retailers, small restaurants, and a flexible stock of vendors. The promenade sequence of spaces blurs the line between market and not-market, extending out into the public realm. One prime example of the market promenade as an extension of the market into public space is the Mercato Centrale in Florence. The market building is on two levels, the upper being a food court and the lower a more traditional fresh food market. The streets surrounding the market are lined with outdoor stalls, mostly selling leather goods, that extend for a block in any direction and fill the market piazza. These stalls effectively move the entrance to the market from the physical doors to the street ends at major

thoroughfares Via Nacional and Piazza San Lorenzo. This extended promenade effortlessly guides visitors through aisles of leather vendors, through fresh food retailers, and into a food court with plenty of seating. By forcing a path through the several faces of the market, chance encounters and business can be increased, vendors have more potential customers, and visitors are confronted with a wider variety of options.

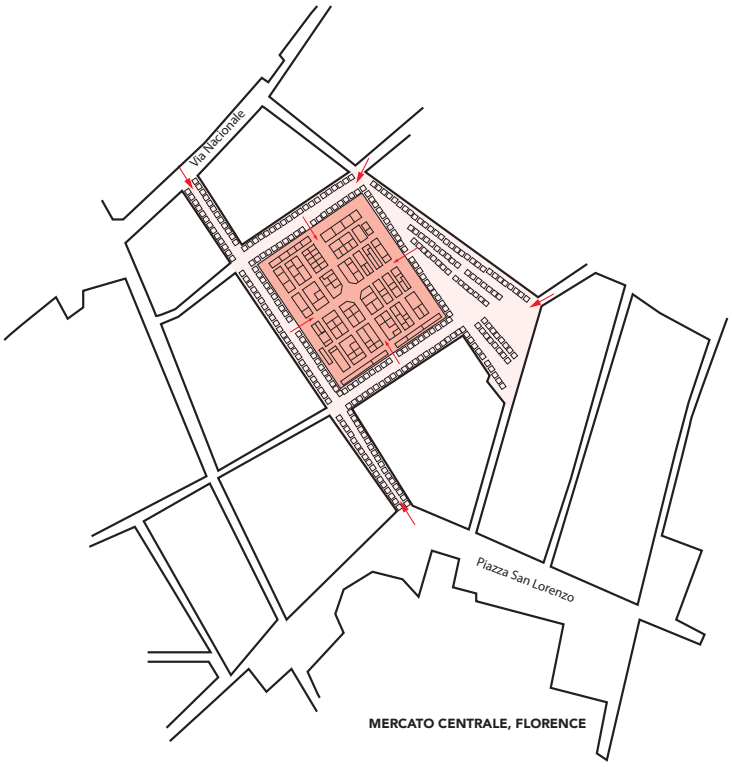


Figure 54: Street vendors effectively move the entrances of the Mercato Centrale outwards. Author

Work space is any back-of-house infrastructure needed for the market to work as a whole or for individual vendors. Production kitchens for vendors, loading docks and receiving areas, space for vehicles for weekly farmers markets, storage space for tables and chairs, waste collection, and building services. This programmatic category is largely unseen by the public, but essential to efficient operations. Discrete

areas of back-of-house functionality can be hidden and shared by a series of stalls depending on arrangement. In R House, the separation of public space and work space is clear, a line of serving counters are supported by individual mini kitchens which all share a common service hallway and receiving area. In Broadway Market, two large stalls effectively hide common cold storage and service space in a poche zone between them. In Spitalfields Market, small eateries are huddled around a central core where they share prep and service space, leaving an ambulatory customer route.

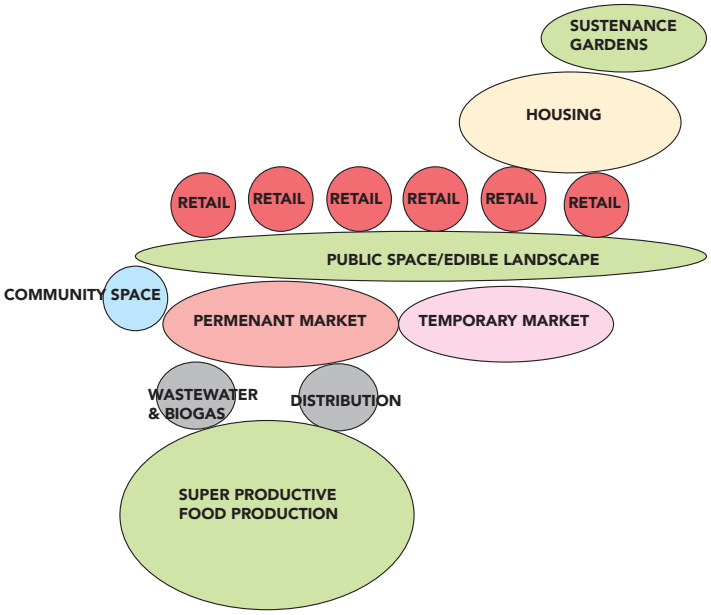


Figure 55: Major programmatic adjacencies. Author

The market landscape includes the public space that leads to and from the market, demonstration gardens, recreation areas, open green space, and other associated public spaces that reference the market throughout the neighborhood. These spaces effectively tie the market into the neighborhood and ensure lively use.

In addition to public spaces, community amenities are placed throughout the site, like a day care center, neighborhood meeting place, and food bank.

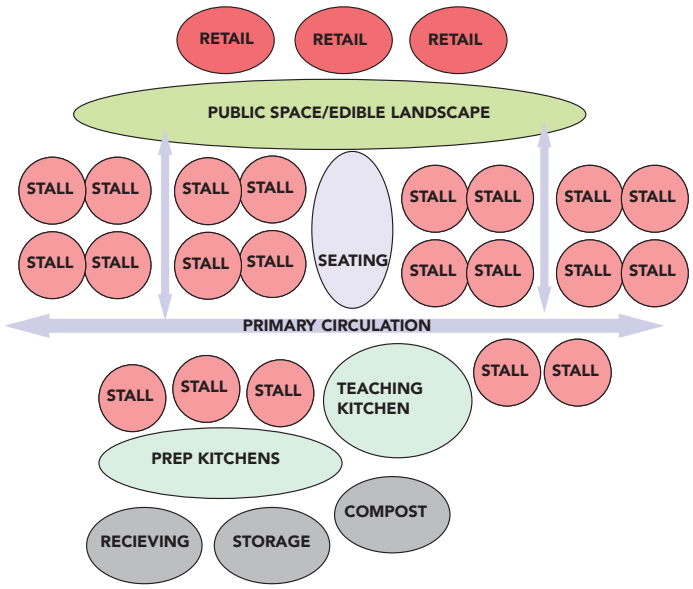


Figure 56: Programmatic adjacencies and general layout of marketplace. Author

Housing

The popularity of housing in downtown Baltimore has grown in recent years. The first high rise housing was built in the 1960's at the Charles Center adjacent to the site. A steady increase in demand has transformed old fabric warehouses just south of the site into loft apartments. In the last three years several former office buildings have been converted to apartments downtown, and the tallest building in Baltimore was recently completed as a luxury apartment building just 6 blocks south of the site. In the model of Pikes Place in Seattle, the design includes a mix of housing opportunities with abundant affordable housing options. In order to tie in with the Bromo Tower Arts District and Howard Street as "The Avenue of the Arts",

a portion of the housing program is set aside for artist live/work spaces. These artist spaces are paired with performance spaces and galleries on Howard Street.

Agriculture

Urban Agriculture permeates the site through an edible landscape, or "urban forest" described earlier. Fruiting trees line streets, and public spaces are studded with two acres of demonstration gardens. Individual housing units are paired with personal sustenance gardens, and one million square feet of space is used for intensive indoor agriculture. This amount of space can feed 50,000 people consistently for the year. The space is broken up into many elements necessary for growing and distribution of this high volume of food. A typical floor level of indoor farm includes a clear circuit from seeding to harvesting, with space for receiving, storage, seeding, growing, harvesting, and prewashing produce.

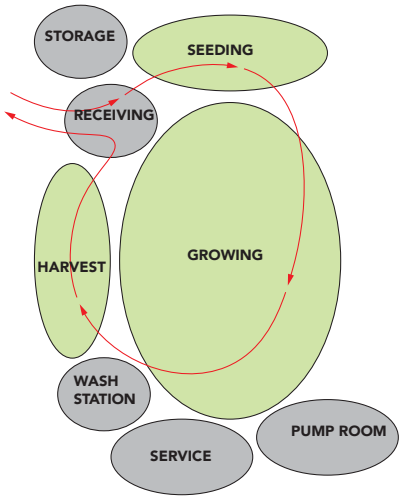


Figure 57: Linear path of indoor agriculture. Author

The many levels of indoor farm share a series of spaces that prepare food for distribution and descend from the growing levels down to the loading docks. Produce goes through spaces for sorting, washing, curing, cold-storage, packaging, and distribution. Additional building services needed for the indoor farms include a central biogas digester where plant clippings and compostable waste are turned into renewable energy, and a compost storage and distribution center.

Urban agriculture can be integrated with housing in various ways. The personal sustenance garden can exist on the exterior of every unit, gathering sunlight and showcasing greenspace vertically. Housing blocks can wrap around indoor farms which require no light, much like a residential block might surround a parking structure, and a modular mix of agriculture and housing units highlights people's interconnectedness with food growth.

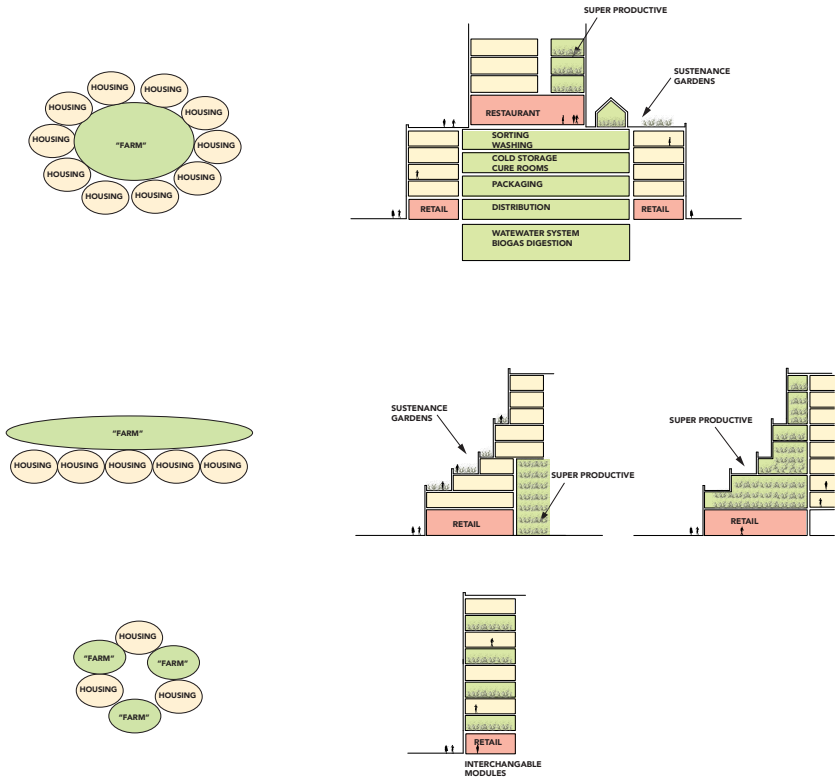


Figure 58: Aggregation possibilities between agriculture and housing. Author

Parking

The site currently has 1800 parking spaces, mostly in two large garages at the market. The revived market is designed to be in a pedestrian oriented environment, where people live and work nearby and the existing mass transit lines can be leveraged to increase the userbase. This would indicate a drastic reduction in necessary parking spaces, however a large increase in housing units necessitates adequate parking. The design uses an equivalent number of spaces, 1800, but alters their intended audience, from market-goer to resident.

Spatial Comparison

The largest programmatic category is urban agriculture, including both indoor and outdoor, public and private food production. This element will result in food for over 50,000 people distributed throughout the city, connecting the market district to the larger region in an intimate way. Housing is the next largest programmatic area, ensuring a steady user base and constant activation of streets. The market and retail shops are a relatively small portion of the total program but provide the development impetus and action potential for the district, connecting food and the public realm.

Figure 59: Program breakdown by size. Author

Chapter 7: Design Considerations

Introduction

There are numerous design considerations that factor into the expression of the market and other elements of the designed neighborhood. Among them are zoning restrictions, planning objectives, best practices, and analogous design concepts.

Zoning

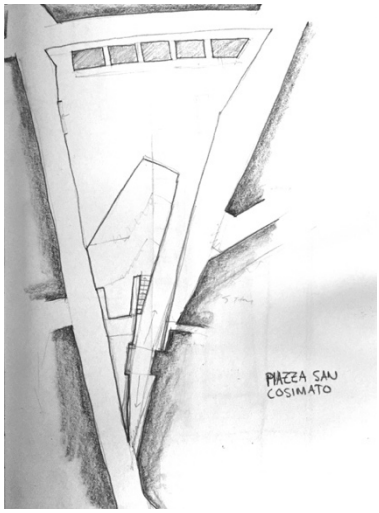
The site area exists in a special development area of Downtown Baltimore, zoned C-5-DC which is the densest zoning area in the city. There are no requirements for setbacks, side yards, or maximum height. There is also no restriction on Floor Area Ratio, however in order to fit into the context, the development does not abuse this allowance. Typical high-rise buildings in downtown reach 30-35 stories, including the residential towers of the neighboring Charles Center development. Though possible, it would be out of place to extend far beyond this common benchmark.

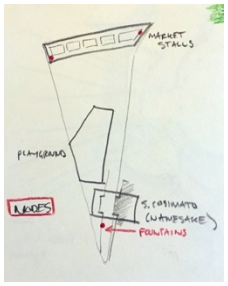
The historic buildings of Howard Street on site are under a preservation ordinance that requests new infill buildings and additions adhere to the street-wall and have parapets at the average height of the block but allow for additional building height that is set back fifteen feet from the street-wall. This ensures the continuance of historic character in the area while allowing for taller buildings and denser blocks.

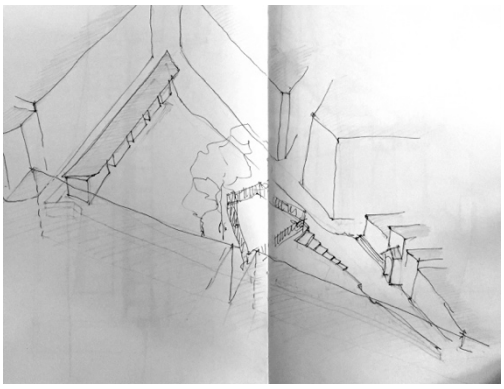
The stated objectives of the special development area include prioritizing walkability and pedestrian activation. This is made evident in the design through an extended promenade through the public realm including flexible space for temporary market activities.

Adaptability

Temporary markets require on site storage space for seating and tents, public restrooms, and some vendor facilities. These types of working spaces are included in Piazza San Cosimato in Rome which has a daily morning market that transitions to a neighborhood recreation space in the evenings. The piazza has a series of small lockable sheds under a canopy that store market equipment, house small shops, provide seating and shade for the public, and make a protected street edge. These kinds of facilities are necessary for a successful temporary market and can be optimally designed to be integrated with public space and be useful during market hours.







Figures 60, 61, 62: Piazza San Cosimato, Rome. Author, 2016

Modularity

Markets are made of a collection of individual businesses, outdoor markets are usually a collection of ten-foot-square tents, a consistent module. Design inspiration for other elements of the program, like housing and indoor farming, can be gathered from the modular quality of the marketplace. Housing lends itself to a modular aggregation because of consistent unit sizes. Recently Studio Precht has released a theoretical design for a modular tower featuring alternating units of housing and farming. The two work together to create a triangulated structure, and each unit has a personal urban farming plot. Using a similar method to pair sustenance gardens with housing units has the capacity to make a 21st century homestead, a self-sufficient home in a vertical stack.

Materiality

Mentioned in detail earlier are plans for the integration of waste and water systems with vertical farming to create self-sustaining urban agriculture. Energy, water, and waste uses and operational outputs are important to the sustainability of the district, but so too are the embodied energy of the building materials used to construct it. Concrete and steel have prevailed as the dominant structural materials for modern cities, but each has a high embodied energy and carbon cost. Mass timber can have similar structural performance to steel or concrete but with a net-negative carbon footprint. Mass timber is also designed to be prefabricated in pieces off-site which greatly reduces construction time, transportation costs, and the carbon footprint of building construction. One of the benefits and motivations for designing a large

vertical farm is to reduce the carbon footprint of food, therefore it is fitting to design the facility to do the same.

Mass timber buildings are often carbon neutral at the end of construction. Thick mass timber walls can be engineered to have R-values that reach passivhaus standards. Glulam beams can be fabricated, like steel, to have nearly any span and load. Cross Laminated Timber panels are two-way slab systems that perform nearly identical to reinforced concrete with far less dead load.

These considerations on materiality, modularity, adaptability, and zoning all play a crucial role in the design of the market district.

Chapter 8: Design Conclusions

Necessary Background, the Verbal Presentation

The following is a summation of the verbal presentation given 12/11/2019 which distills all the relevant information discussed in the previous chapters and leads into the design of the new food district.

Figure 63: Title slide, final presentation. All images by Author, 2013-2016

10 years ago, I visited Lexington Market for the first time and thought: where is all the food? The market was then, as it is now, full of bodega-like stalls selling chips and candy, fried chicken stands, and vacant stalls. Out of 97 stalls, 10 sold meat, fish, or produce; 35 are vacant. In the central public market of Baltimore, the oldest in the country, I expected abundance but found scarcity.

Figure 64: Six views, interior of Lexington Market. Author, 2019

This thesis is about food, about how to replenish an abundance of good food, of availability and access in the inner city

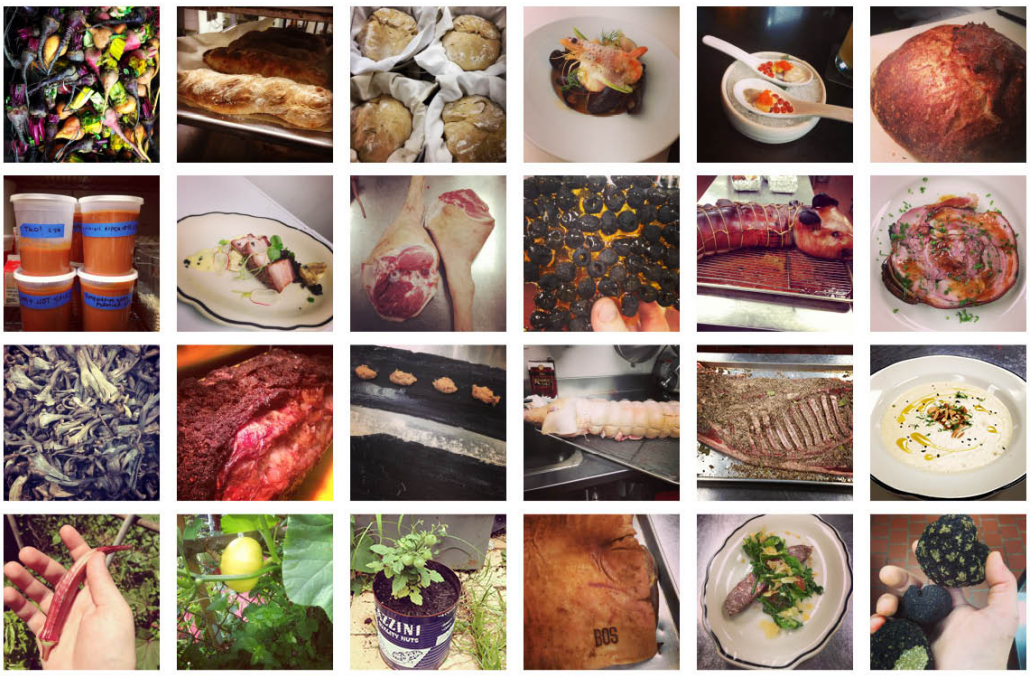


Figure 65: Abundance. All images by Author, 2013-2016

In Baltimore there is a scarcity of good food in many neighborhoods, replaced by junk foods that are linked to obesity and health problems plaguing poorer residents. These food deserts ring downtown and include 18% of the city's residents.

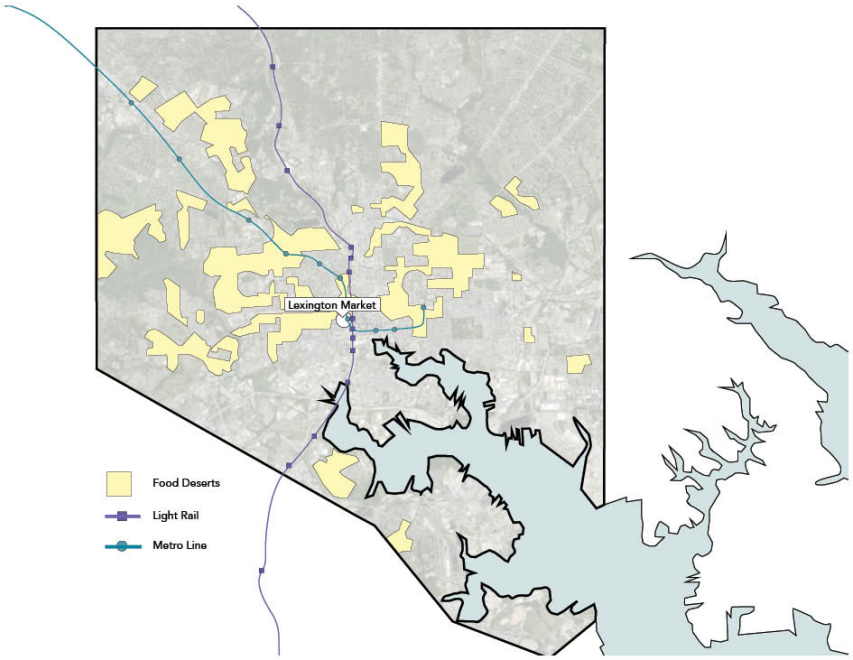


Figure 66: Food Deserts in Baltimore. Author, 2019

Why is there not abundance and access in the inner city? Part of the problem is that our food is produced far, far away from the consumer. Not only does this distance us from the food we eat, the variety available and nutrition, but it places an enormous carbon cost on our food due to transportation.

Our food has not always relied on a global transportation network. Our urban history from the roman castrum to the Garden City movement was based on a degree of self-sufficiency. An urban core was surrounded by farmland which in turn was surrounded by untouched nature. However, since then, cities have grown and the

surrounding farmland has transformed into suburban sprawl, which has turned the untouched nature into farmland.

This kind of growth cannot continue. In the next 30 years, the earth's population will rise by 2.5 billion people, most of that in cities. If we were to continue converting farmland into living space, and forests into farmland, the results would be catastrophic.

Cities require an enormous amount of land elsewhere in order to feed themselves. Baltimore requires an area equal to 5 times it's land area in order to feed itself. New York is only slightly larger but because of its density requires an enormous amount of space to feed itself. We can densify the food production industry just like housing in cities. Stack productive land in towers, and reverse the model of city surrounded by farm, to one of the farm surrounded by and providing for the city. This is Urban Agriculture.

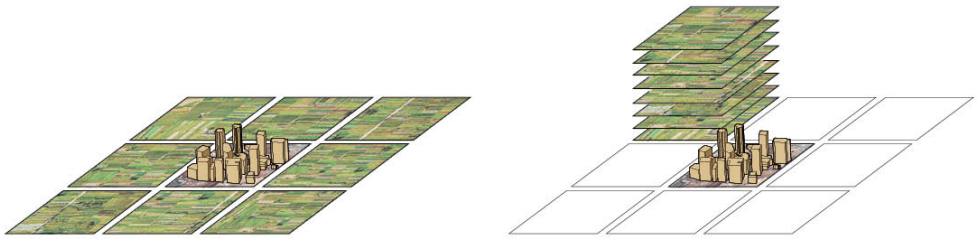


Figure 67: Stacking productive land. Author, 2019

Figure 68: Inversion of the relationship between farm and city. Author, 2019

Urban agriculture has three primary archetypes: the edible landscape where food is grown in the public realm, on streets, where tree lined boulevards become orchards, and edible food can be found anywhere; the sustenance garden, where private spaces produce a portion of food for a family, in backyards or terraced occupiable roofs; the super-productive vertical farm, where crop yields and efficiency can skyrocket due to a controlled environment and the ability to stack farmland vertically.

I found an ideal site for this idea, the inclusion of vertical farms in the city, in Baltimore's historic Lexington Market. Where redevelopment of the market can work in conjunction with food production.

Figure 69: Lexington Market in context downtown. Author, 2019

The market sits just a few blocks from the inner harbor and two blocks west of the Charles Center, the original landmark downtown redevelopment.

The market was once one of the busiest in the world, and along with a string of department stores formed the commercial heart of Baltimore. The original market was three blocks long, extremely porous, and surrounded by retail and related

businesses, it thrived. The market is something other than the usual blocks, it was navigable as an element of the public domain. It was a recognizable icon.

After a fire in the late 1940's the market was rebuilt as it is today: a block sized, nearly windowless warehouse that interrupts Lexington Street, and surrounded by parking structures.

I found an opportunity here to redesign the marketplace with the addition of urban agriculture. To both revive a struggling piece of public infrastructure, and to demonstrate the efficacy of bringing a super-productive landscape into the city.

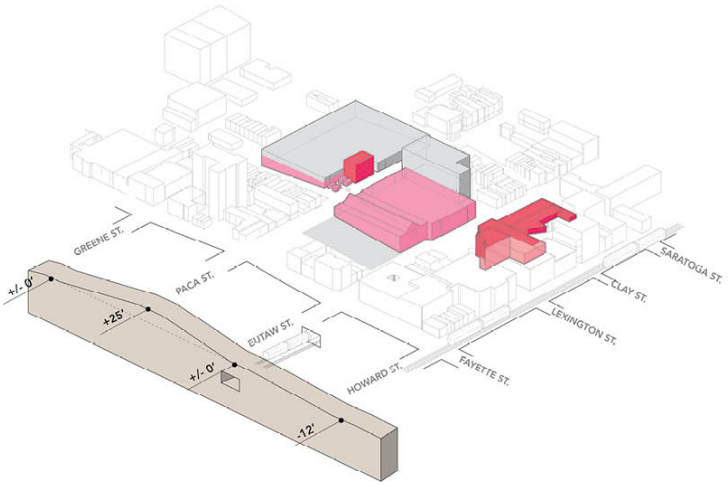


Figure 70: Existing Market. Author, 2019

The market sits on a hill, the crest on Paca St. at 25' above Greene St. to the West and Eutaw St. to the East. The market physically cuts off Lexington street here.

The market is extremely well connected, both mass transit lines have existing stops within a block of the market.

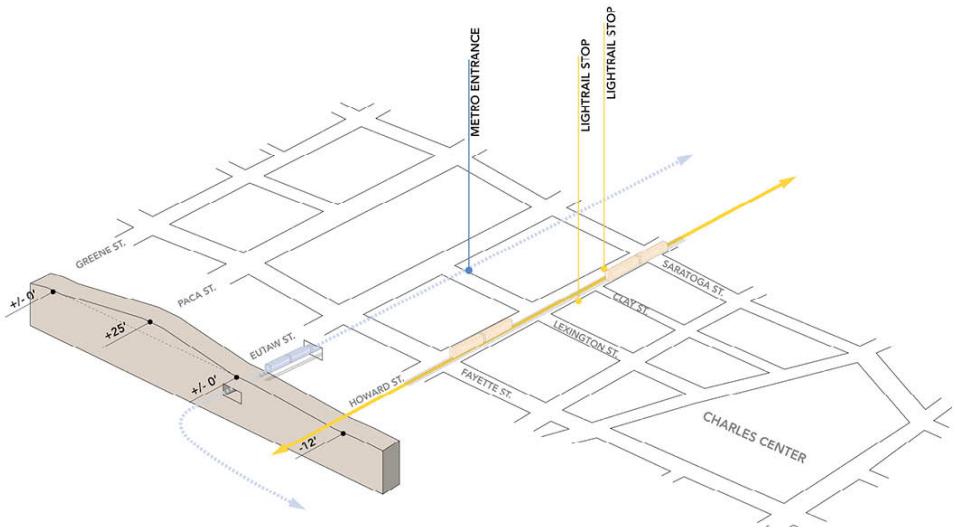


Figure 71: Mass transit on site. Author, 2019

In order to effectively connect the site to the city I reintroduced Lexington street, and added an additional pedestrian street and plaza connecting Howard and Greene Streets, and existing at the level of Eutaw and Greene, passing under Paca Street.

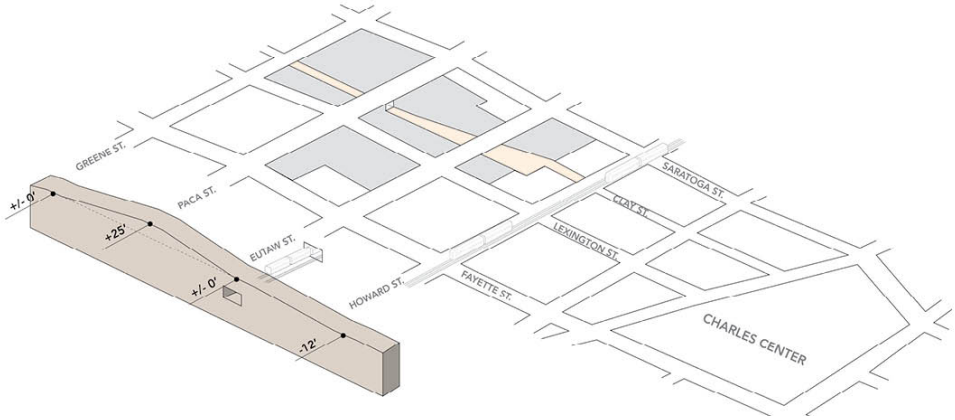


Figure 72: Re-mapping Lexington Street, adding secondary pedestrian street. Author, 2019

The market absorbs the grade change, with a long ground floor spilling out to the pedestrian plaza, and access from the ridgeline to a second floor and a rooftop demonstration garden.

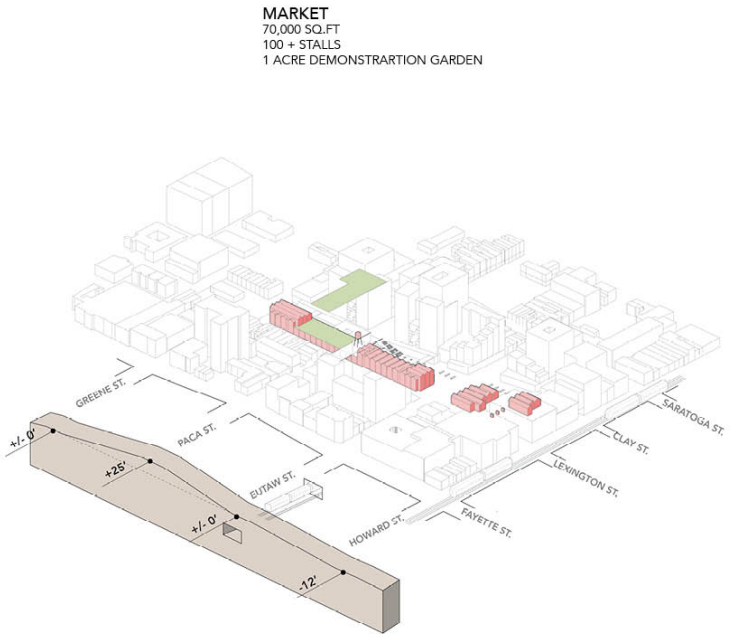


Figure 73: Market. Author, 2019

Four blocks were chosen to create a system of vertical farms, connected via a basement level to a central distribution area and the biogas digester. The tunnel also connects directly to the market for retail purposes and to funnel organic waste from the market directly to the Biogas Digester.

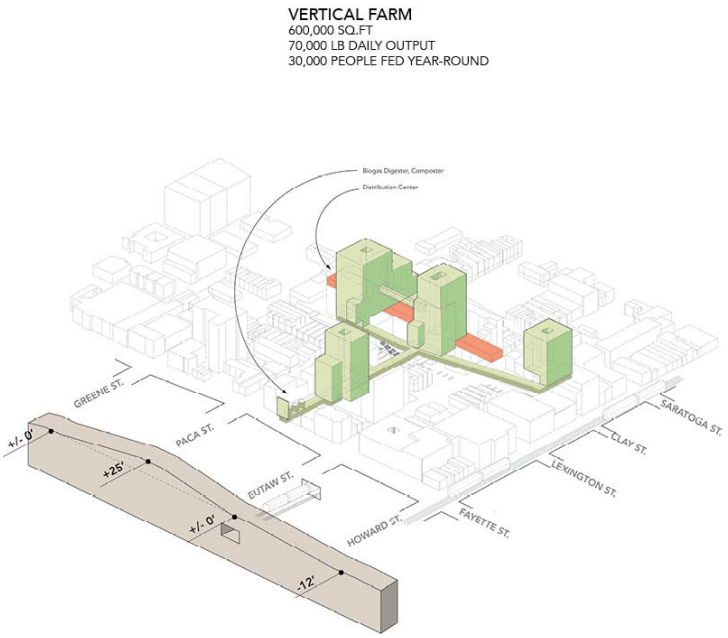


Figure 74: Vertical Farm System. Author, 2019

Each vertical farm is surrounded by housing, nearly doubling the residents in a ¼ mile radius, and providing an energetic base for the area as a mixed-use community. 850 units are added, housing 2000 residents.

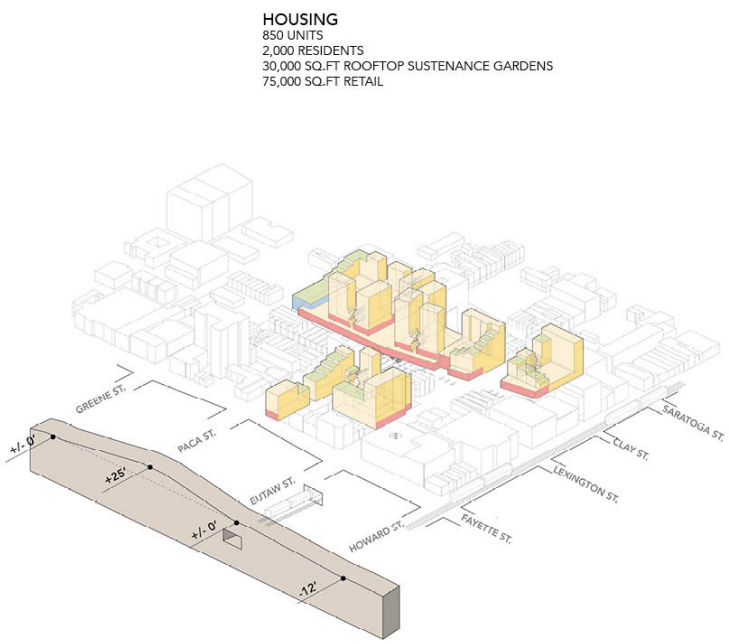


Figure 75: Housing. Author, 2019

The market and vertical farms represent producer and consumer working together, where food can be grown, picked, cooked, sold, and eaten on site. But if this is to be a symbiotic relationship, the path cannot be linear, but cyclical whenever possible.

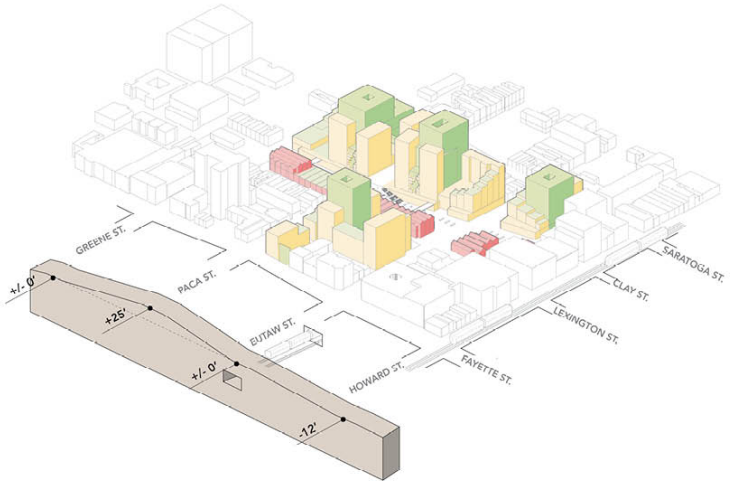


Figure 76: Market, Farm, and Housing working together. Author, 2019

Organic waste from the different users: vertical farm clippings, restaurant trash, and household organic waste is fuel for biogas digestion, which provides a considerable portion of the power needed to run the vertical farms. Rainwater collected on roofs is stored in an iconic water tower to water outdoor gardens. Greywater from apartments is filtered for use in the vertical farm, and cyclical nutrient relationships are fostered within the VF between produce and aquaculture.

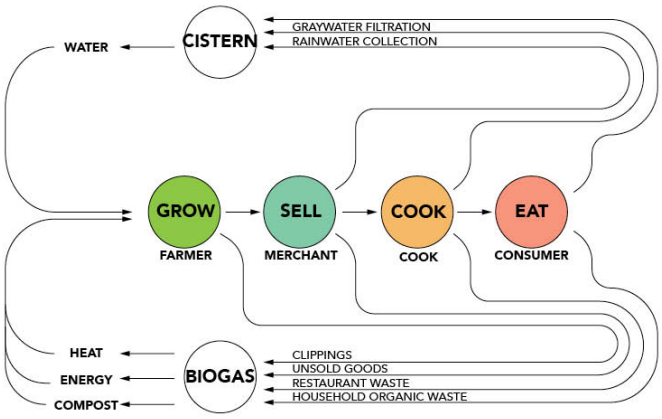


Figure 77: Cyclical relationships: how to use food waste as input for farming. Author, 2019

The typical block is farm surrounded by city, using the interior of the block for the farm and courtyard space, and lining streets with housing, giving the best access to light and air and views to people. Visual connections are made wherever possible to let residents observe and connect with the food grown in the vertical farms.

Figure 78: Typical Block, housing. Author, 2019

The farms have ample glazed frontage to both exhibit them to the public and provide a maximum amount of natural light. Lightwells bring more light to interior spaces and shape the space to accommodate a cyclical flow of produce from seedling to harvest.

Figure 79: Typical Block, vertical farm. Author, 2019

Availability of natural light exists in a gradient through the farm tower, which can be used to effectively program the mix of produce grown on each floor. Some require more light than others, placing high-light-need plants where they can gain the most without artificial lighting increases productivity.

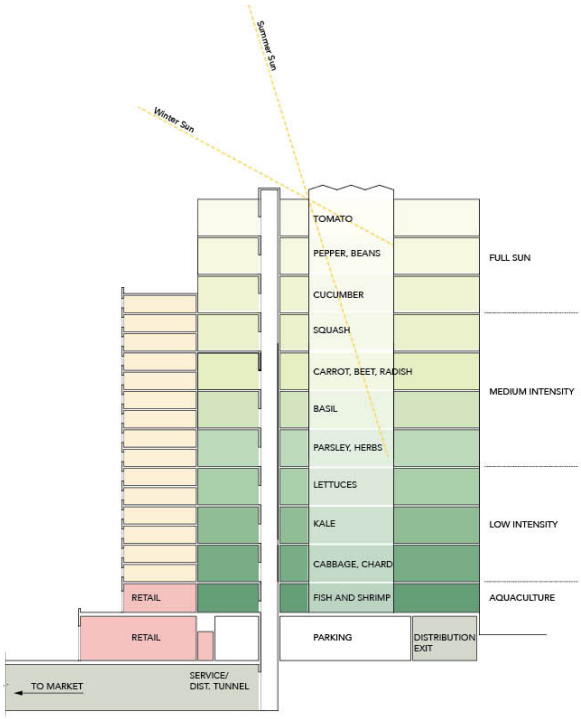


Figure 80: Gradient of available natural sunlight and opportunity for produce programming. Author, 2019

The actual footprint of the farms is quite small in the city. The growing area stacked into them is much larger, roughly the size of Patterson Park. With the efficiency of indoor farming, hydroponics, and a 365 day growing season taken into account, the farm has an effective area even larger. Roughly 4% of the city's need.

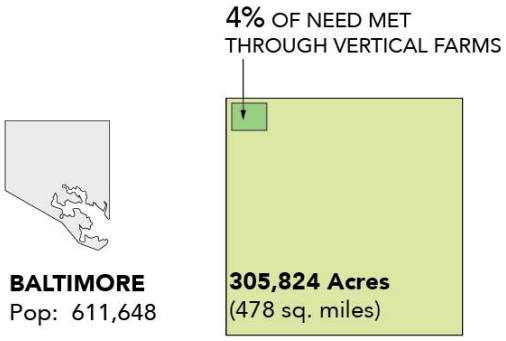


Figure 81: Productivity of vertical farm compared to city's annual need. Author, 2019

The new market is analogous to the original Lexington Market, a linear building made of repeatable, navigable modules that spills out onto a pedestrian plaza. Within the market, stalls are organized with a sidedness towards the public realm, with a service alley to the south. Larger stalls with direct access to a service hallway and deliveries can be small restaurants or production kitchens. Stalls on the floor can be retailers (butchers, creameries, local farms, and produce from the vertical farms). Stalls range in size from 75 SF to 150, 300, or 600 SF with the ability to combine and reconfigure so the market can evolve as it needs to. The highest density of stalls occurs at the street entrances where traffic will be heaviest.

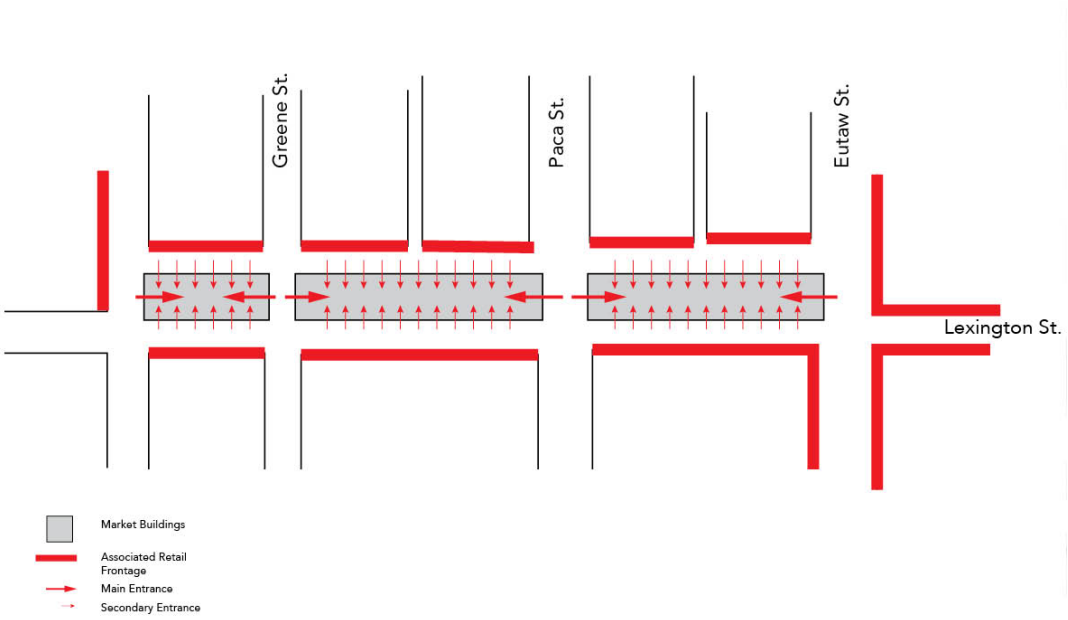
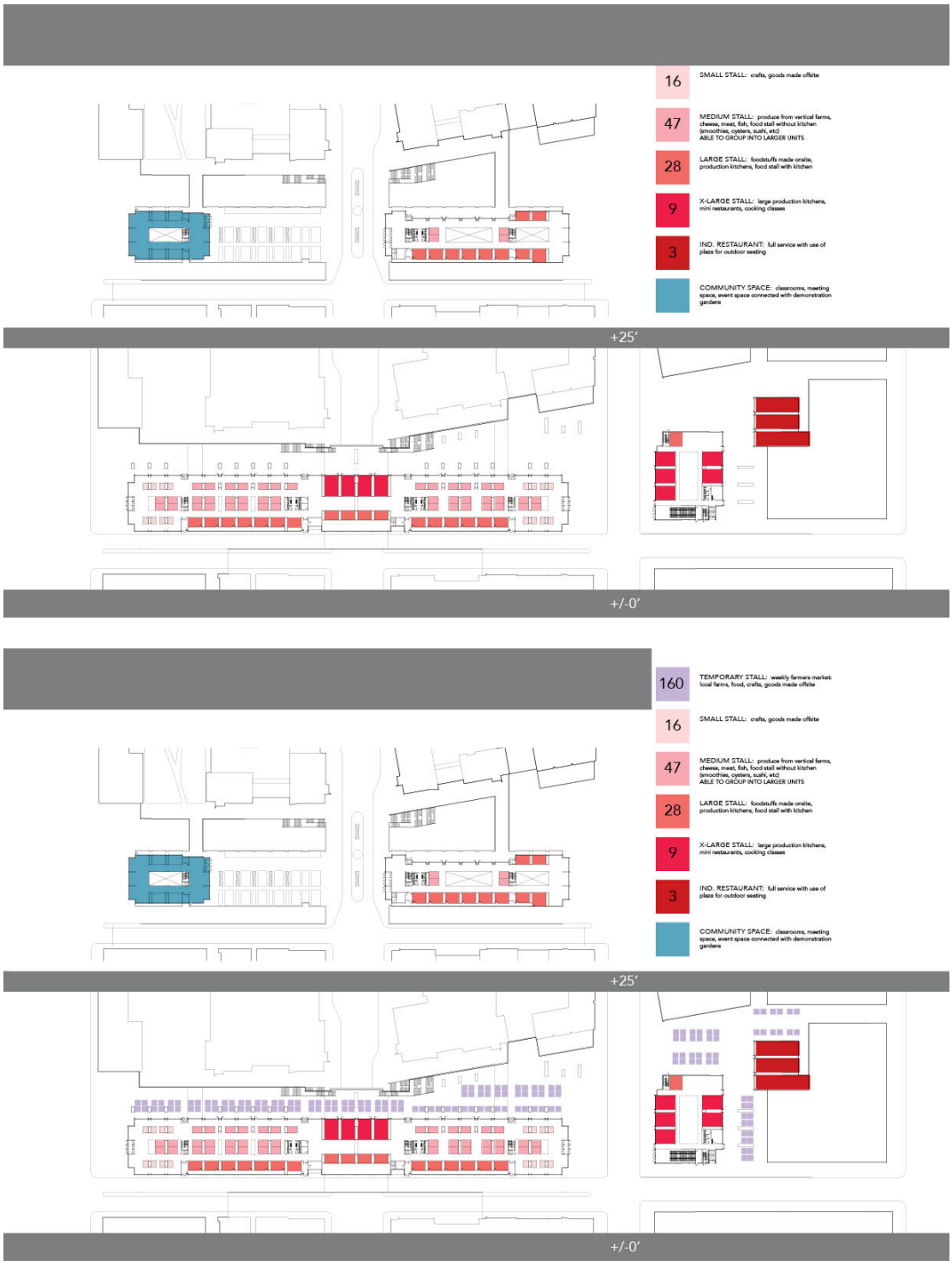


Figure 82: Historic Lexington Market diagram. Author, 2019

Figure 83: Site plans. Author, 2019



Figures 84, 85: Distribution of stalls by size and expansion of market into public plaza. Author, 2019

Temporary markets, like a relocation of the city's popular JFX Farmers Market and Bazaar can fill the plaza and act as an effortless expansion of the market outside.

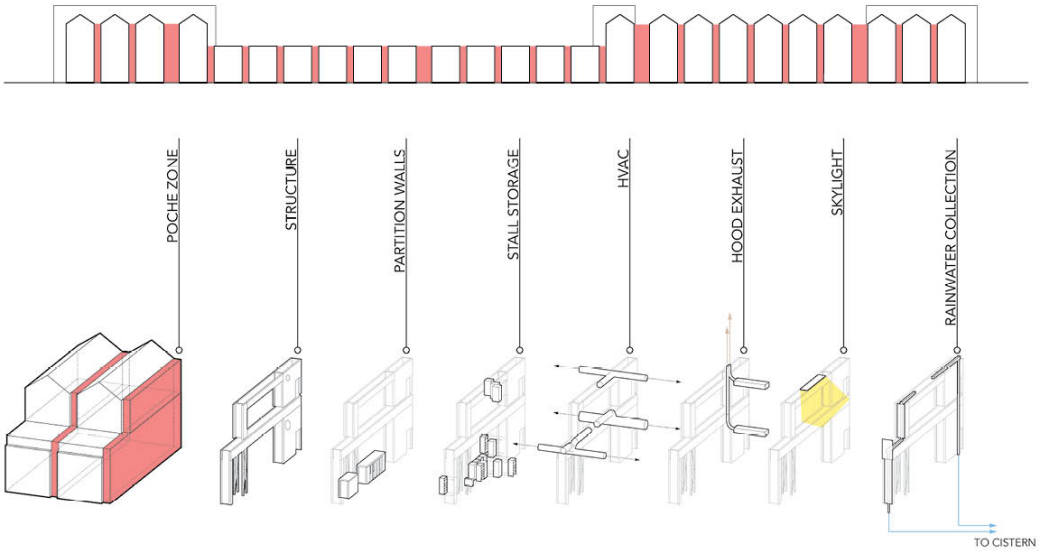


Figure 86: Poche space in Market. Author, 2019

The market itself is based on a series of repeatable modules, where interstitial poche space combines structure, building systems, and storage.

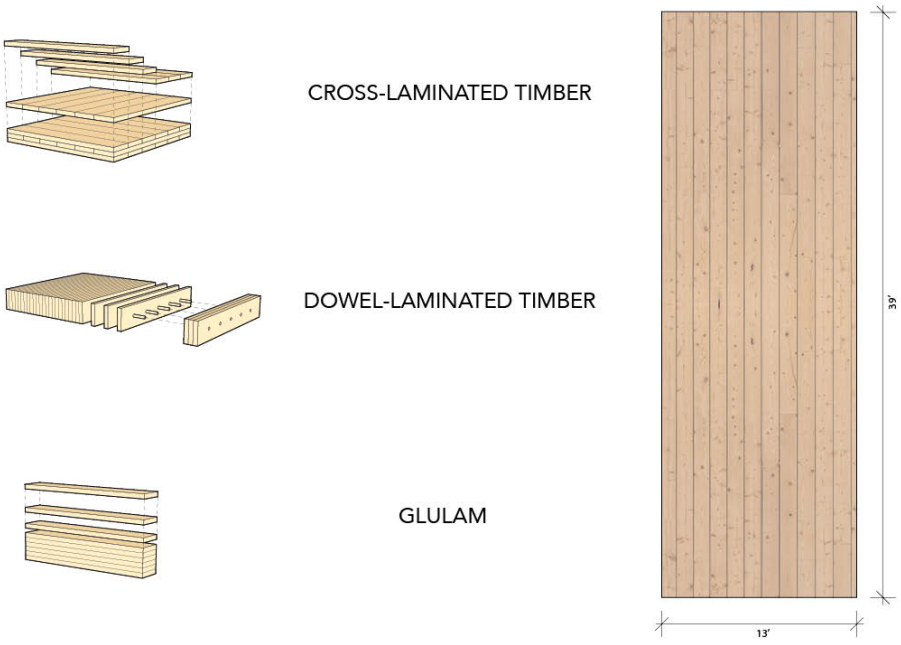
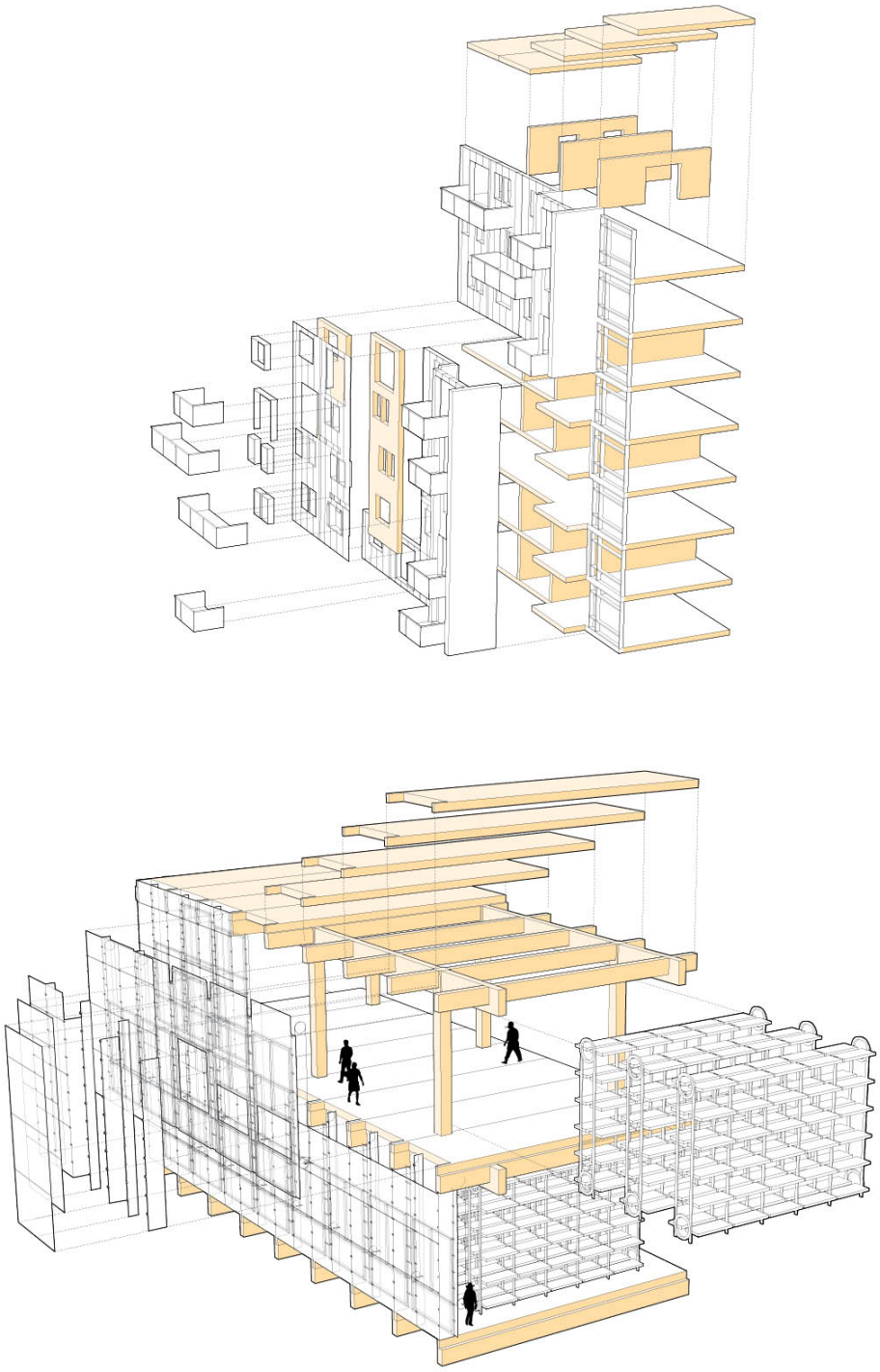


Figure 87: Mass timber strategies. Author, 2019

The structure of the market, and the whole district, is mass timber. The housing blocks use a standard CLT sheet as a common modular dimension (13' x 39'), letting each unit be a multiple of this standard sheet. This allows the demising walls and floor slabs become a stable "egg-crate" matrix, using those demising walls as load bearing structure. The matrix is supported and stabilized by an exterior CLT shear wall where each sheet spans multiple floors. The vertical farm structure is simple column and beam, using CLT and common growing rack dimensions to inform the column placement. The towers are stabilized by concrete cores. The glazed portions of the farm towers have a double envelope system that lets a maximum of light in, while reducing heat loss, and allowing fresh air to enter without risk of birds, insects, and other pests.



Figures 88, 89: Mass Timber in housing and vertical farm. Author, 2019

The market structure defines the aforementioned poche space with a sandwich of glulam beams. This primary structure is connected by a grid of beams that make

an essential wooden waffle slab to support the roof and gardens above. The second floor of the market has a pitched roof made of two Dowel-Laminated-Timber sheets with embedded holes as skylights. These are not windows placed into the roof, but rather the spaces where the ceiling doesn't exist. This DLT is wrapped by a continuous glass envelope above, making an elegant, simple solution to both allowing skylights, and the necessary weather barrier over the timber.

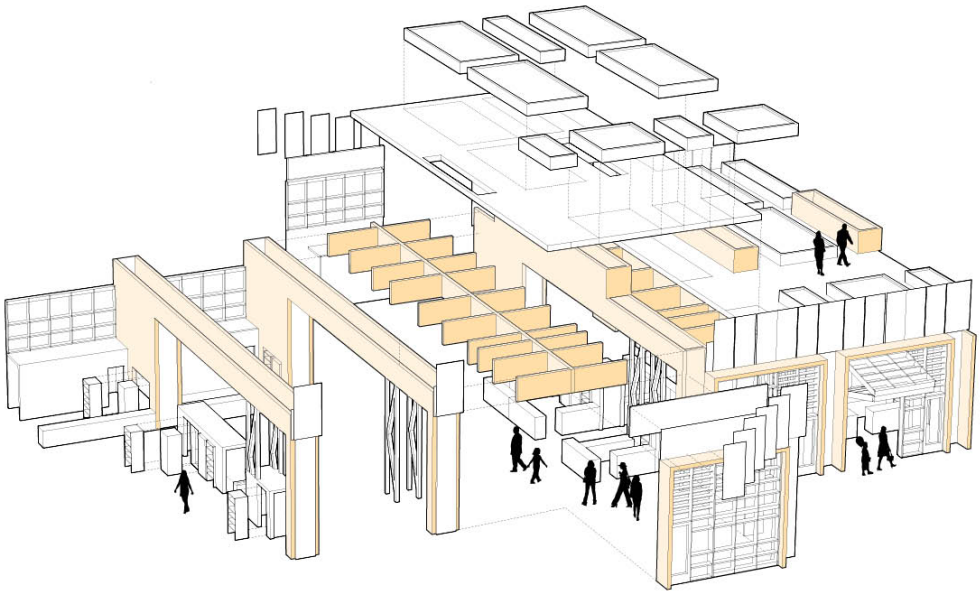


Figure 90: Mass Timber in first floor, market. Author, 2019

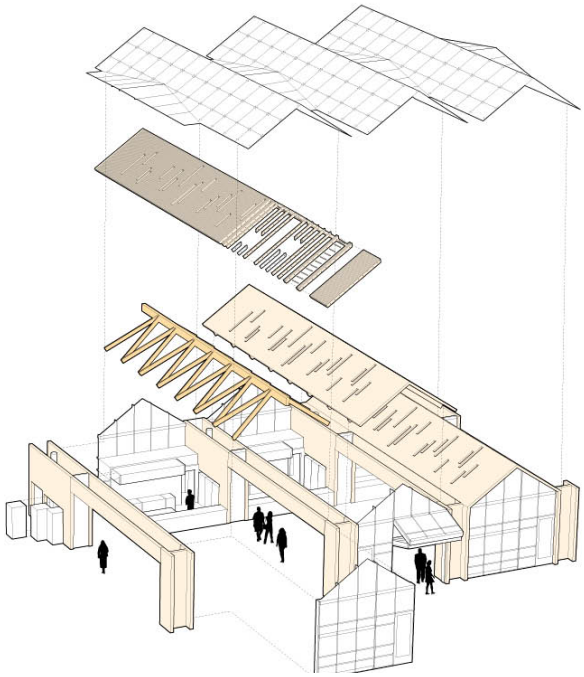


Figure 91: Mass Timber in second floor, market. Author, 2019

The new market is the centerpiece of a new sustainable food district, a gateway to downtown rebirth, and a shining example of integration of our food systems in the city.

Figure 92: Section Perspective through site looking West. Author, 2019

Presentation Drawings

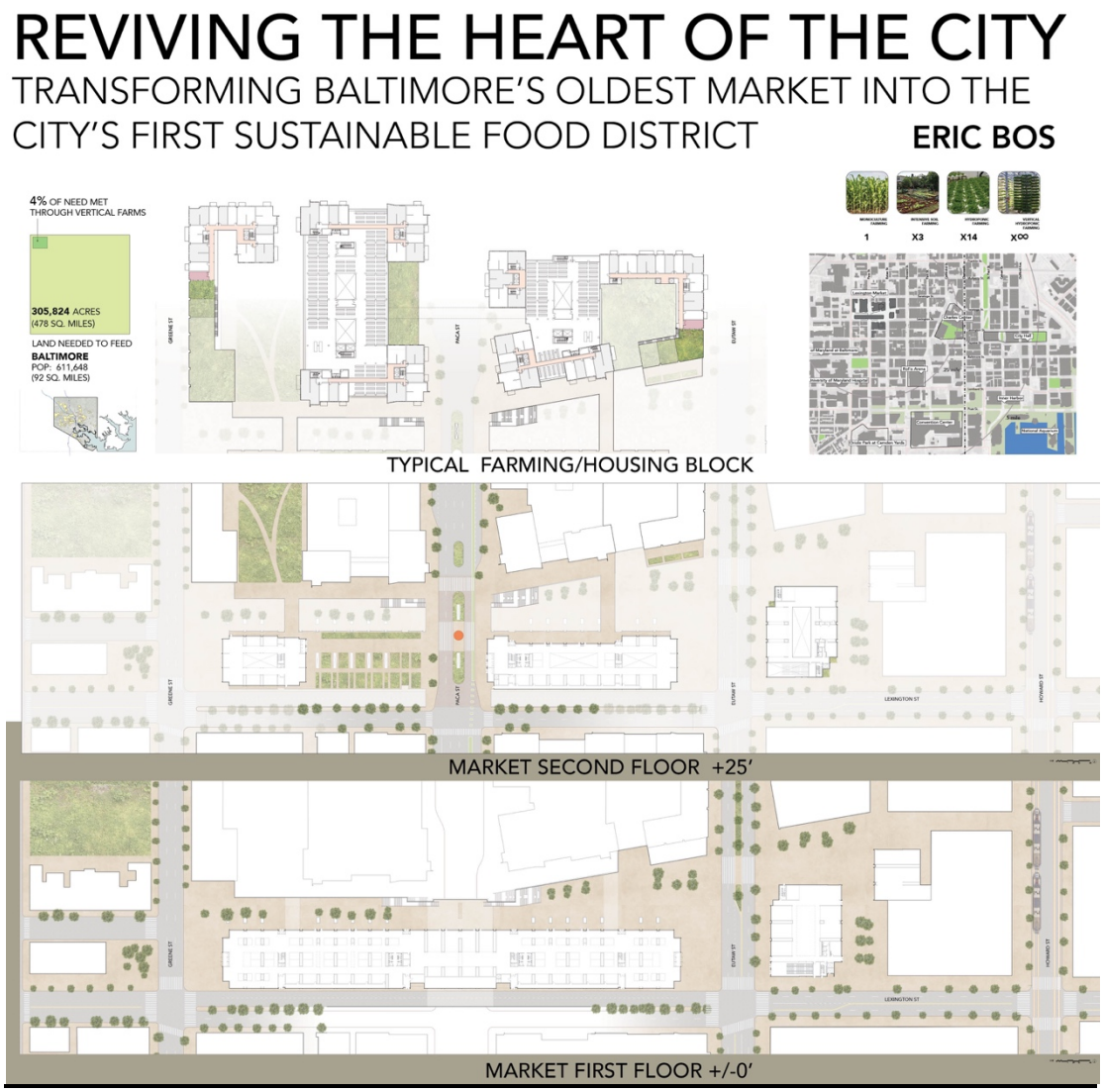


Figure 93: Presentation Boards 1 and 2. Author, 2019

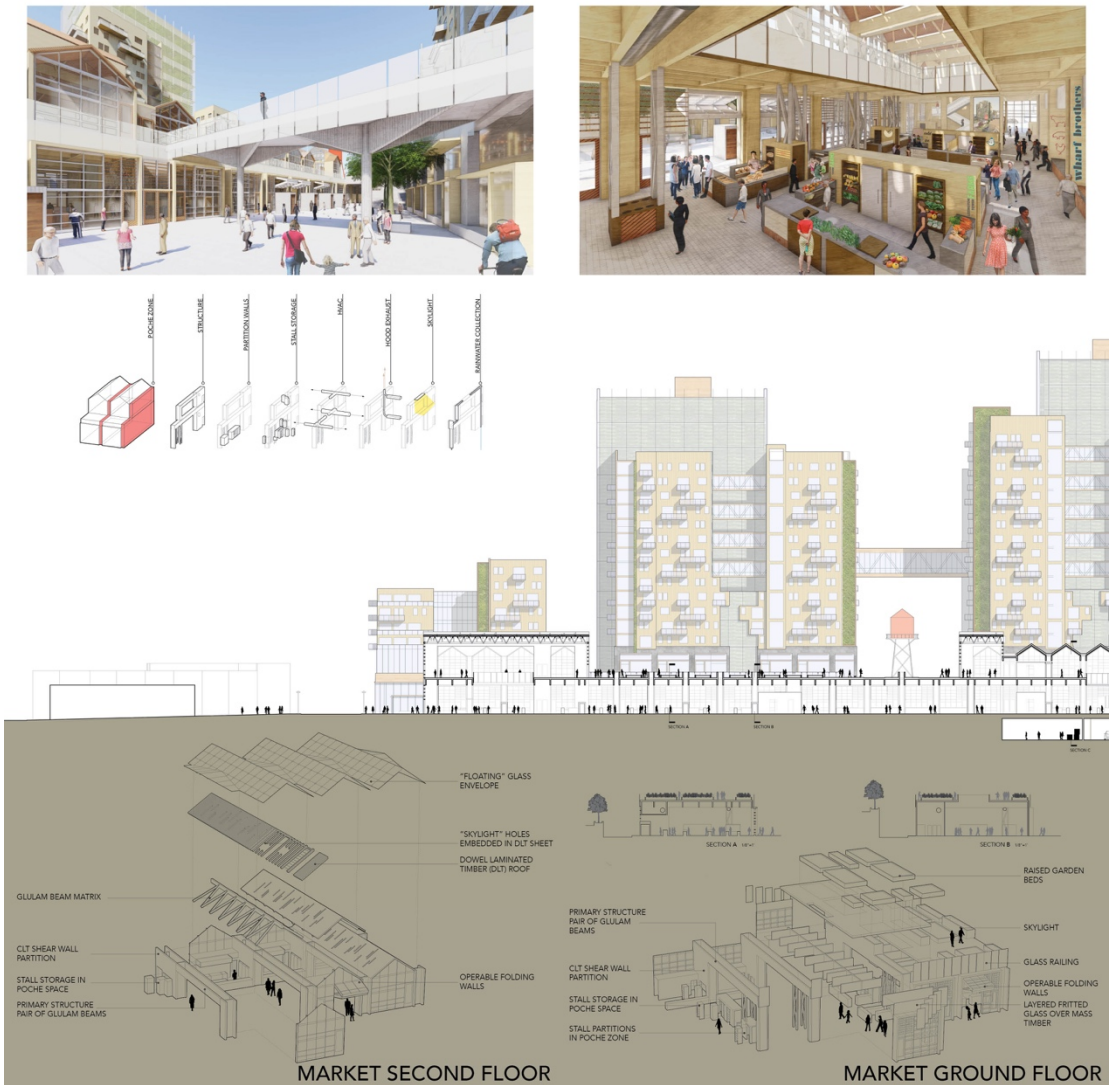


Figure 94: Presentation Boards 3 and 4. Author, 2019

Figure 95: Presentation Boards 5 and 6. Author, 2019

Figure 96: Section through market facing North. Author, 2019

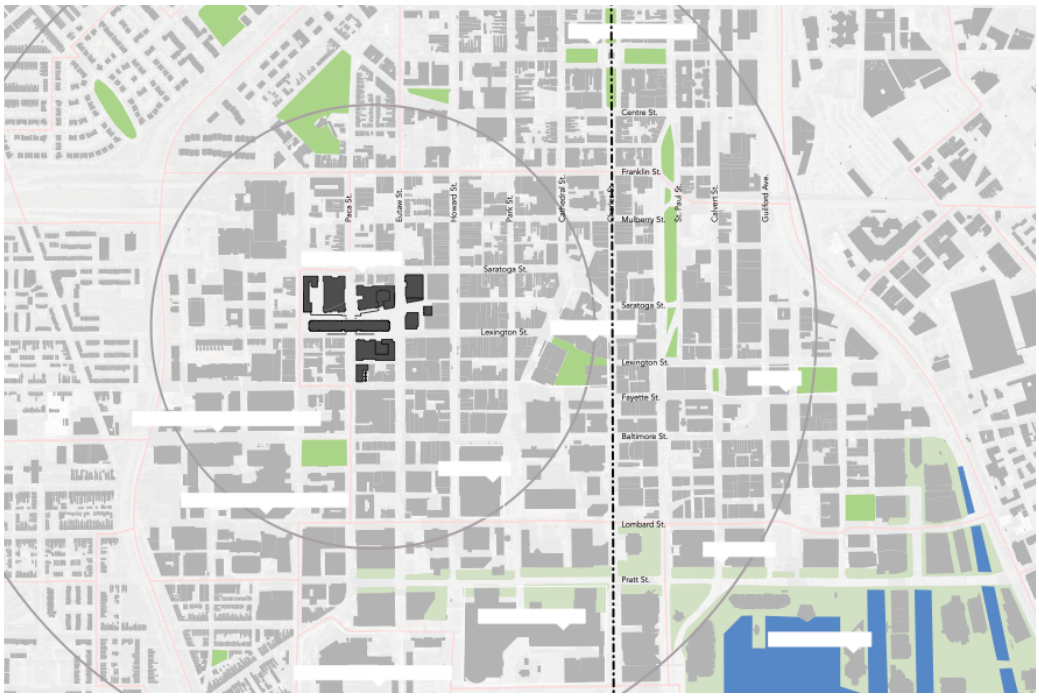


Figure 97: Site Plan of new development. Author, 2019

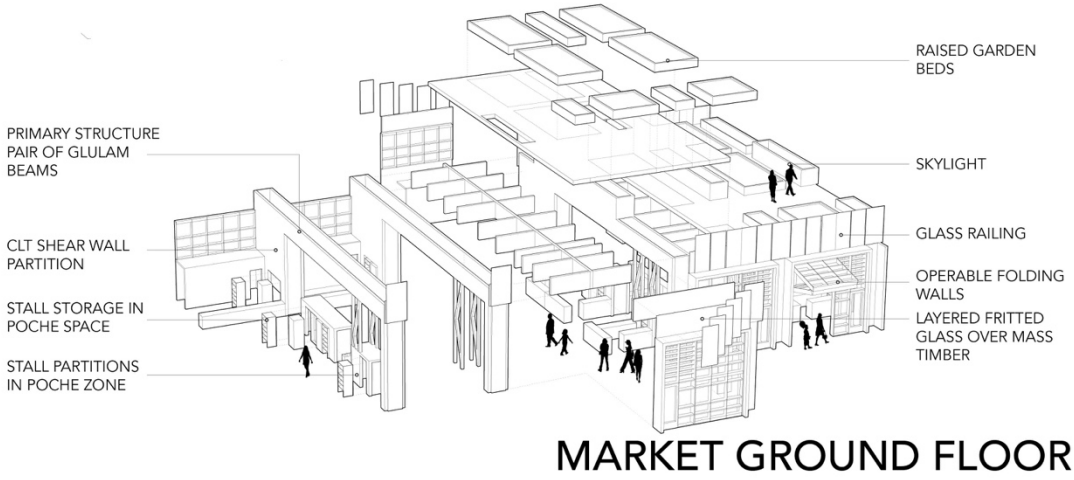


Figure 98: Assembly, Market Ground Floor. Author, 2019

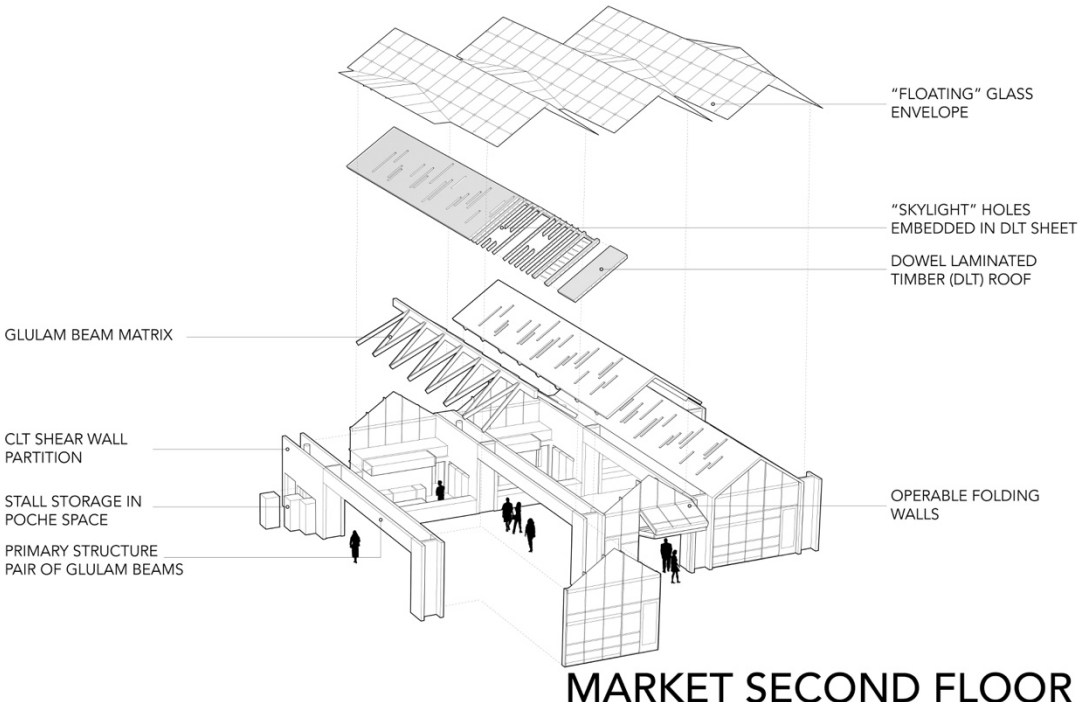


Figure 99: Assembly, Market Second Floor. Author, 2019

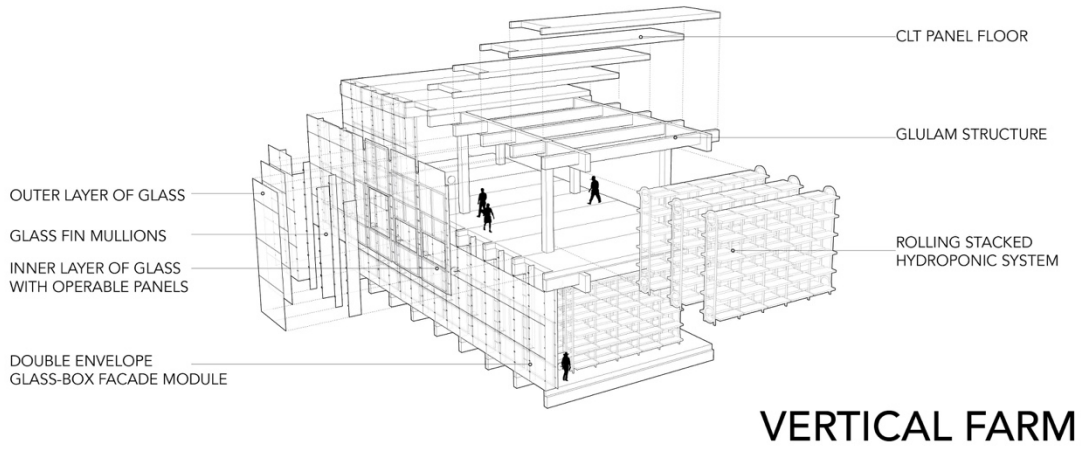


Figure 100: Assembly, Vertical Farm. Author, 2019

Figure 101: Vignette: Market from balcony of housing unit looking North. Author, 2019

Figure 102: Vignette: Market interior. Author, 2019

Figure 103: Vignette: Upper level plaza looking down to Market and East to Downtown. Author, 2019

Figure 104: Vignette: Lower level plaza looking West. Author, 2019

Figure 105: Vignette: Market second floor. Author, 2019

Figure 106: Physical model of two typical bays of the Market. Author, 2019

Figure 107: Physical model of two typical bays, roof and floor structure detail. Author, 2019

Appendices

Reflection on Thesis Review:

The verbal presentation was very well received, some remarking that the arguments made for vertical farming were some of the most convincing so far heard. Though details about the housing component of the district were kept deliberately vague and diagrammatic, conversation quickly turned to the details of the housing, the feasibility, and organization.

The mass timber structures were explained in more detail and argued that they represent the future of best-practices for urban architecture due to carbon sequestration and speed of construction.

The topic of technology vs ecology was brought up in regard to future food systems, i.e. how we can remain connected to the earth while growing efficiently and vertically. It was explained to the jury that food as technological achievement and food as urban ecology were both represented in the district—the vertical farms being hyper-efficient technology-driven food sources, and the rooftop demonstration gardens and terraced sustenance gardens representing the natural ecological systems that create food through the urban eco-system.

The exploded details were well regarded and little was presented as argument. It was agreed that the roof system, glass over DLT with “skylight” holes, was an elegant solution replacing embedded skylights, flashing and roofing with a continuous glass envelope. Direct light from above was thought to be possibly contentious for stall keepers who might prefer diffuse light over their wares.

It was mentioned that the section perspective could be used in the future as the one drawing that explains this scheme, the integration of food systems in cities, and urban design for vertical farms. It was also mentioned that more people could be put in renderings, to make the market seem like the bustling markets of Europe.

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